Engineering Library

The Engineer.

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VOL. CXLIX.—No. 3880] LONDON: FRIDAY EVENING, MAY 23, 1930 [PRICE {WITH SUPPLEMENT} ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

The Director-General, India Store Department, Belvedere-road, Lambeth, London, S.E. 1, invites TENDERS for :—

SCHEDULE 1.—175 STEEL DOUBLE-SIDE TIPPING WAGONS.

SCHEDULE 2.—14,300 INDIA RUBBER DRAW SPRINGS for Rolling Stock.

3200 INDIA RUBBER BODY SPRINGS for Rolling Stock.

65,000 INDIA RUBBER BUFFER SPRINGS for Rolling Stock.

Tenders due as follows :—
Schedule 1, 18th June, 1930.
Schedule 2, 25th June, 1930.

Forms of Tender available from the above at a fee (which will not be returned) of 5s. for each Schedule. 5071

Offers are Invited for the PURCHASE of SIX 2-TON ELECTRIC PORTAL CRANES at present installed on the Wharf at Takoradi Harbour, Gold Coast Colony, the process of development of the harbour rendering other methods necessary for handling goods. These cranes are a well-known make, of recent construction and are in good working order, having been but little used.

For further particulars and the conditions of purchase apply to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting O/Prod. 0634. 5058

Crown Agents for the COLONIES.
COLONIAL GOVERNMENT APPOINTMENTS.

APPLICATIONS from qualified candidates are INVITED for the following POSTS :—

M/2015.—ASSISTANT ENGINEERS (12) REQUIRED by the GOVERNMENT of NIGERIA for the PUBLIC WORKS DEPARTMENT for two tours of not less than 12 nor more than 18 months' service in the first instance. Subject to satisfactory service, the officers appointed will be eligible at the expiration of three years' service for confirmation in the permanent and pensionable establishment. Salary £480 a year for the first three years; then £510, rising by annual increments to £920. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates must have attained the age of 21½ years on the date of appointment, and should preferably have attained the age of 22½ and must not be over 35 years of age. Must have obtained an Engineering Degree at a recognised University or have passed Sections "A" and "B" of the A.M.I.C.E. examination or have passed the Associateship in Civil Engineering of the City and Guilds Institute, or possess such other degree or diploma or distinction in Engineering as may be considered satisfactory. Candidates whose qualifying diplomas have been obtained without a College course should have had three years' practical experience of Civil Engineering under a qualified Civil Engineer. It is preferred that all candidates should have had two years' practical experience on good Engineering work subsequent to taking their degree or completing their articles, but under certain conditions this may be waived in the case of candidates in possession of an Engineering Degree.

M/2180.—ASSISTANT ENGINEER REQUIRED by the GOVERNMENT of NIGERIA for the HARBOUR DEPARTMENT for a tour of 12 to 18 months. Salary £600, rising to £720 a year by annual increments of £30 and thence rising to £920 a year by annual increments of £40. Outfit allowance of £60 on first appointment; free quarters and passages and liberal leave on full salary. Candidates, 25 to 35 years of age, must be fully qualified Civil Engineers who have had experience in Harbour and Trigonometrical Surveys.

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting the reference number against the appointment for which application is made. 5088

Department of Scientific and Industrial Research.

APPLICATIONS are INVITED for TWO VACANCIES at the Ditton Research Laboratory, East Malling, Kent. Duties will include routine work in making accurate temperature observations and in running refrigerating machinery. Candidates should have a good general education and preferably engineering or laboratory experience. Age not exceeding 30. Pay from £2 10s. to £4 a week, depending on qualifications and experience.—Application forms may be obtained from the SECRETARY, Department of Scientific and Industrial Research, 16, Old Queen-street, S.W. 1, to whom they should be returned not later than May 31st. 5042

INDIAN SERVICE OF ENGINEERS AND INDIAN RAILWAY SERVICE OF ENGINEERS.

The Secretary of State for India in Council will, in the near future, APPOINT NINE ASSISTANT EXECUTIVE ENGINEERS (including, if possible, one Burman, who will be appointed to the India recruited branch in Burma) to the INDIAN SERVICE of ENGINEERS; and THREE ASSISTANT EXECUTIVE ENGINEERS to the INDIAN RAILWAY SERVICE of ENGINEERS. Except for the Burman appointment, every candidate must be an European British subject of non-Asiatic domicile.

Candidates must have attained the age of 21 years and must not have attained the age of 24 years in the case of those applying for appointment to the Indian Service of Engineers, and 25 years in the case of those applying for appointment to the Indian Railway Service of Engineers, on 1st January, 1930.

They must either (1) have obtained one of certain recognised University Degrees or other distinctions in engineering, or (2) have passed Sections A and B of the Associate Membership Examination of the Institution of Civil Engineers or been exempted by the Institution from such examination, or (3) have passed the Associateship in Engineering of the City and Guilds Institute (Imperial College of Science and Technology, South Kensington), or (4) produced the required evidence that they are otherwise eligible under the Regulations. They should in addition have had about one year's approved practical experience in engineering.

Applications from candidates must reach the India Office not later than 30th June, 1930. Printed forms, together with information regarding the conditions of appointment, may be obtained from the SECRETARY, Services and General Department, India Office, Whitehall, S.W. 1.

India Office,
April, 1930. 4794

THE ENGINEER.

PLEASE MAKE A RECORD THAT ALL FUTURE COMMUNICATIONS SHOULD BE ADDRESSED TO:—

28, ESSEX STREET, STRAND, LONDON, W.C. 2.

The Engineer

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PUBLIC NOTICES

Derbyshire Education Committee.

APPLICATION is INVITED for the POST of LECTURER in ELECTRICAL ENGINEERING. The person appointed will be attached mainly to the Heanor Mining and Technical School, but will also be required to lecture at one of the other County Mining Schools. Salary in accordance with Burnham Scale for Teachers in Technical Schools. Forms of application may be obtained from the undersigned, to whom they must be returned, accompanied by copies of not more than three recent testimonials, not later than June 11th.

P. G. FEEK,
Director of Education.
County Education Office, Derby. 5065

The Technical College, Port Elizabeth.

The Council invites APPLICATIONS for the POST of
ENGINEERING WORKSHOP INSTRUCTOR.
Scale of salary for qualified and experienced man, £400-20-500.

Applications should be received not later than 24th June by Messrs. G. H. PENNEY and CO., 23, Lime-street, E.C. 3, from whom further particulars can be obtained. 5061

Armourers' and Brasiers' Company.
LECTURES IN METALLURGY.

The Company have arranged for the following LECTURES to be delivered :—

At the Institution of Electrical Engineers, Savoy-place, Victoria Embankment, W.C. 2, at 5.30 p.m. on 21st May, 28th May, and 4th June, 1930, by J. FERDINAND KAYSER, Esq., Assoc. Met., on "PERMANENT MAGNETS AND MAGNET STEELS."

At the Sir John Cass Technical Institute, 31, Jewry-street, Aldgate, E.C. 3, at 7 p.m. on 27th May, 3rd June, and 10th June, 1930, by GEO. PATCHIN, Esq., A.R.S.M., M. Inst. M.M., on "MICRO-EXAMINATION OF ENGINEERING METALS AND ALLOYS."

ADMISSION FREE, WITHOUT TICKET. 4997

PUBLIC NOTICES

University College of Swansea.

The Council invites APPLICATIONS for the POST of ASSISTANT LECTURER in the Department of Metallurgy. Salary £300 per annum. The appointment will date from the 1st September, 1930.

Further particulars may be obtained from the undersigned, by whom applications must be received on or before the 28th May, 1930.

EDWIN DREW,
Registrar.
Singleton Park, Swansea. 4962

City of Chichester.
SUPPLY OF 10in. CAST IRON WATER MAINS.

The Town Council of the City of Chichester invites TENDERS for the SUPPLY of approximately 2000 YARDS of Class C 10in. CAST IRON WATER MAINS and SPECIALS as required.

Further particulars and form of Tender may be obtained from Mr. Frank J. Lobley, A.M. Inst. C.E., the City Engineer, "Greyfriars," Chichester. Tenders, in sealed envelopes, endorsed "Water Mains," to be delivered at my office, East-street, Chichester, not later than Noon on Monday, the 9th day of June, 1930.

The lowest or any Tender not necessarily accepted.

J. W. LOADER COOPER,
Town Clerk.
Chichester, 21st May, 1930. 5077

City of Nottingham.

The Passenger Transport Committee is prepared to receive TENDERS for the SUPPLY and DELIVERY of 300 TONS of STEEL TRAMWAY RAILS of British manufacture.

Copies of the specification and form of Tender may be obtained on application to Mr. T. Wallis Gordon, City Engineer and Surveyor, Guildhall, Nottingham, on payment of a deposit of One Pound, which will be returned on receipt of a bona fide Tender.

Sealed Tenders, in the official envelope provided, are to be delivered to the undersigned not later than 6 p.m. on Wednesday, June 11th, 1930.

The lowest or any Tender will not necessarily be accepted.

Tenders will only be accepted from firms who conform to the conditions of the contract as regard paying the local standard rate of wages, &c.

W. J. BOARD,
Town Clerk.
Guildhall, Nottingham,
17th May, 1930. 5057

PUBLIC NOTICES

Fylde Water Board.
TO TURBINE MAKERS.

The Board are considering the INSTALLATION of IMPULSE TYPE WATER TURBINES and 40-50-kW GENERATORS, and invite interested firms to submit a TENDER in accordance with particulars and specification, which can be obtained on application from the undersigned.

GEO. F. ATKINSON, M. Inst. C.E.,
Engineer.
Head Office,
Sefton-street, Blackpool,
16th May, 1930. 5050

County Borough of Doncaster.
PUBLIC ASSISTANCE DEPARTMENT.
THE POOR LAW INSTITUTION, DONCASTER.

TENDERS are INVITED from responsible and experienced Contractors for the REMOVAL of TWO 30ft. by 7ft. 6in. LANCS. BOILERS and the SUPPLY and ERECTION of TWO NEW 30ft. by 8ft. 6in. LANCS. BOILERS. GREENS ECONOMISER, INDUCED DRAUGHT PLANT, PIPE WORK and AUXILIARIES, including the PROVISION of BOILER SEATINGS, ECONOMISER CHAMBER and FLUES.

Specifications may be obtained and drawings seen at the office of the Consulting Engineers, G. J. Gibbs and Partner, 7, Lune-street, Preston, on deposit of the sum of £5, which will be refunded on receipt of a bona fide Tender and return of all documents.

Tenders, endorsed "Tender for Central Heating," to be delivered to the undersigned not later than 10 a.m., Monday, June 23rd, 1930.

The Council do not bind themselves to accept the lowest or any Tender.

Dated this 20th day of May, 1930.

W. BAGSHAW,
Town Clerk.
Public Assistance Offices,
Wood-street, Doncaster. 5067

Egyptian Government.

TENDERS are CALLED FOR by the Mechanical Department, Ministry of Public Works, Cairo for the SUPPLY and ERECTION of TWO PUMPING UNITS for Ameria Pumping Station, including 2 Diesel Four-stroke Type Engines, with Air or Airless Fuel Injection, driving 2 Centrifugal Pumps and 2 Small D.C. Generators; Electrically Driven Auxiliary Compressor; 10-kW Auxiliary D.C. Generator driven by Four-stroke I.C. Engine; usual Station Accessories. All to be delivered and erected at site. Contractor also to provide necessary station buildings.

Tenders should be submitted direct to the DIRECTOR-GENERAL, Mechanical and Electrical Department, Ministry of Public Works, Cairo, not later than Noon on the 6th August.

Copies of the necessary conditions of Tender, specifications and drawings, &c., can be obtained on application to the Chief Inspecting Engineer, Egyptian Government, 41, Tothill-street, S.W. 1, against remittance of £1 0s. 6d. per set, which sum is not returnable. Copies of these documents are also available for scrutiny at the above address.

Firms on the Continent should apply to the Egyptian Consulate in their respective countries for the above documents. 5051

South Indian Railway Company, Limited.

The Directors are prepared to receive TENDERS for the SUPPLY of :—
PIG IRON (16 TONS).

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked :—"Tender for Pig Iron," with the name of the firm tendering, must be left with the undersigned not later than 12 Noon on Friday, the 6th June, 1930.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 2s. 6d. for each copy of the specification.

A. MUIRHEAD,
Managing Director.
91, Petty France,
Westminster, S.W. 1,
21st May, 1930. 5080

Applications are Invited from persons possessing the qualifications of A.M.I.C.E., B.Sc. Eng., &c., or the equivalent, for the POSTS of ASSISTANT ROAD ENGINEERS in the Roads Department of Southern Rhodesia.

The initial salary will be at the rate of £400 per annum, and appointments will, in the first instance, be on a temporary basis, subject to one month's notice on either side. If the services of successful applicants are retained, increments will be governed by regulations controlling scales of salary for professional and technical officers.

Applicants must state age and submit copies of testimonials with full statement of qualifications and experience, also stating the earliest date on which it is possible to assume duty.

Selected candidates will be required to pass a stringent medical examination by the Government's doctor in London.

Preference will be given to unmarried men below the age of 35.

Applications should be addressed to the HIGH COMMISSIONER FOR SOUTHERN RHODESIA, Crown House, Aldwych, London, W.C. 2, by the 31st May, 1930. 5043

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PUBLIC NOTICES

Broadstairs and St. Peters

URBAN DISTRICT COUNCIL.
WATERWORKS DEPARTMENT.
STATION ENGINEER.

The above-named Council invite APPLICATIONS for the APPOINTMENT of STATION ENGINEER, in Charge of their Pumping Station at Rumfield, St. Peters.

Applicants must be competent to Take Charge of the Pumping Plant, which includes Vertical Oil Engines, Deep-well Pumps, Softening Apparatus, &c.; and have had practical workshop experience, as the person appointed will be responsible for carrying out all running repairs.

The salary is £250 per annum, rising by annual increments of £20 to a maximum salary of £350 per annum, payable monthly. A small house adjoining the pumping station will be provided rent free.

Applications, which must be made on a form obtainable from the undersigned, must reach me not later than 29th May, 1930.

E. F. OWEN,
Clerk to the Council.

Pierremont Hall,
Broadstairs,
May 15th, 1930. 5041

Clyde Navigation Trust.

SUPERINTENDENT OF HARBOUR WORKS.

APPLICATIONS are INVITED for the POST of SUPERINTENDENT of HARBOUR WORKS. The duties comprise the Control, under the Trustees' Civil Engineer, of all Repairs and Maintenance of Dock Walls, Wharves, Goods Sheds and other Properties belonging to the Trustees, as well as the Charge of the Repair Workshops at Govan. Experience in Underwater Work, Piling and Reinforced Concrete Work is desirable. As the work is spread over a large area, candidates must be good organisers, and be capable of and have experience in the handling of men and of giving detailed estimates of the cost of repairs.

Candidates must be under 40 years of age. State salary expected.

Applications, endorsed "Superintendent of Harbour Works," to be lodged with the undersigned not later than Saturday, 31st May.

JAS. MACFARLANE,
General Manager and Secretary.

16, Robertson-street, Glasgow,
14th May, 1930. 5056

COIMISIUN NA STAT-SHEIRBHISE.

POSITIONS VACANT—EXAMINERS OF APPLICATIONS FOR PATENTS OF INVENTIONS.

The Civil Service Commissioners

invite APPLICATIONS for THREE Whole-time Permanent, Pensionable POSITIONS of EXAMINER of APPLICATIONS for PATENTS of INVENTIONS, in the Industrial and Commercial Property Registration Office, Department of Industry and Commerce. Salary scales: Married man, £150-£15-£350; woman or unmarried man, £130-£7 10s.-£250 a year, plus cost-of-living bonus in each case. At present the bonus on £150 is £94 14s., and on £130 is £87 6s. Candidates of approved experience may, in certain circumstances, be allowed to enter the scale at a point above the minimum, but not above £195 in the case of a married man and not above £152 10s. in the case of a woman or unmarried man. Good general scientific education with knowledge of general (including electrical) engineering. Industrial experience in some branch of engineering desirable.

Age limits 25-45 on 1st May, 1930.

Application forms and particulars may be obtained from the SECRETARY, Civil Service Commission, 45, Upper O'Connell-street, Dublin, C. 8.

Latest date for receiving completed application forms, 31st May, 1930. 5046

W. H. Co.

Wakefield Corporation Waterworks.

WANTED, TEMPORARY JUNIOR ENGINEERING ASSISTANT. Must have completed University Course and obtained Diploma. Salary from £130 per annum according to scale.

Applications, accompanied by two testimonials, to be sent not later than 14th June to C. CLEMESHA SMITH, M. Inst. C.E., Waterworks Engineer, Town Hall, Wakefield. 5078

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

THE Master in Charge, Oundle School Workshops, thanks the applicants for the Post of Instructor. This VACANCY has now been FILLED, and testimonials of the unsuccessful candidates will be returned in due course. 5083

WANTED, Young ENGINEER, Experience Pumps. Fluent German. English experience preferred.—Apply in own handwriting to Box R. F., c/o Davies and Co., 95, Bishopsgate, E.C. 2. P7035 A

ASSISTANT ENGINEER WANTED, with Experience of Contractors' Offices.
Apply, EDMUND NUTTALL, SONS and CO., Ltd., Trafford Park, Manchester. P7042 A

ASSISTANT REQUIRED, Preferably with Knowledge of A.C. Electrical Instruments and some D.O. experience; progressive position. State experience and approximate salary.—Address, P7047, The Engineer Office. P7047 A

BRITISH Railway in South America REQUIRES LOCOMOTIVE SUPERINTENDENT to Take Charge of Locomotive Running, Locomotive, Carriage and Wagon Maintenance, Shops Management. Good knowledge of Spanish essential. Salary £1000/1200 and quarters.—Write, stating age, qualifications, experience, present employment, to L.S.A., c/o Street and Co., 6, Gracechurch-street, London, E.C. 3. 5082 A

DESIGNER-ENGINEER, Expert with Practical mechanical experience REQUIRED, to design machines for doing what are at present hand operations; age 25-35.—Address, giving full particulars of experience and salary required, P7034, The Engineer Office. P7034 A

ENGINEER.—ENGINEER REQUIRED for Petroleum Refinery in Burma. Single man, not over 25. Good general practical mechanical training. Drawing-office experience a recommendation.—Write, stating age, with full particulars of qualifications and indication of salary required, to Z.P. 904, c/o Deacon's Advertising Agency, Fenchurch-avenue, London. 5030 A

ENGINEER, SENIOR, with Knowledge of Overseas markets, REQUIRED by Specialist Manufacturers in London area developing export market in Domestic and Heavy Electrical Engineering Products. Experience, age, and salary.—Address, 5055, The Engineer Office. 5055 A

ESTIMATING ENGINEER REQUIRED by Regulator Manufacturers near London. Sound Steam knowledge and some Electrical knowledge essential. Knowledge of French and German special qualifications.—Address, stating age, salary and experience, 5081, The Engineer Office. 5061 A

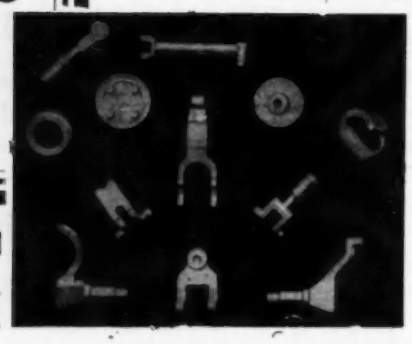
FACTORY MANAGER.—WANTED, Qualified ENGINEER, under 40, to Take Charge of 2 Factories employing 70 to 80 hands. Experience in management is essential.—Write, stating qualifications and salary required, to Box A.L., c/o Davies and Co., 95, Bishopsgate, London, E.C. 2. 5054 A

FIRM of ENGINEERS REQUIRE an ASSISTANT MANAGER to Take Charge in principal's absence. Applicants must have considerable experience in the engineering industry, but must be particularly experienced on the commercial and sales side. A good position is offered to applicants possessing energy and enterprise with ability to control staff. State full particulars and salary required.—Address, 5053, The Engineer Office. 5053 A

DROP FORGINGS

STEEL STAMPINGS

GREY IRON CASTINGS



THE HEATLY-GRESHAM ENGINEERING CO., LTD.
LETCHWORTH, HERTS.

Our unrivalled facilities for the production of DROP FORGINGS, STEEL STAMPINGS, GREY IRON CASTINGS, etc., enable us to quote you the keenest competitive prices. All work from the raw material stage to the finished product is carried out under the expert supervision of highly skilled engineers and our extensive organisation facilitates the expeditious handling of large quantity contracts.

We should appreciate an opportunity of quoting for your next requirements.

SITUATIONS OPEN (continued)

RATE FIXER REQUIRED; Experience in Design of Jigs and Tools an advantage.—Write, stating age, experience, and salary required, to WORKS MANAGER, Electrolux Ltd., Luton. P7069 A

WANTED, DRAUGHTSMAN, Fully Experienced in Gear-box construction; must have technical qualifications and be able to work out calculations for gear and worm wheel design and prepare drawings for same.—Address, 5026, The Engineer Office. 5026 A

WANTED, by Consulting Engineers, London, STRUCTURAL STEEL DRAUGHTSMAN and BRIDGE DESIGNER, experienced in Stress Diagrams.—Address, with copies of references, stating age, experience and salary required, P7071, The Engineer Office. P7071 A

DRAUGHTSMAN and DESIGNER REQUIRED, with sound knowledge of Industrial Instrument design and manufacture, for works, London, N.W. 10, district. Please state fully experience, age, and salary required. No juniors need apply.—Address, P7053, The Engineer Office. P7053 A

DRAUGHTSMAN (Junior Heating) REQUIRED. Must have experience in all classes of Central Heating and Ventilation.—State age, experience, and salary required to G. N. HADEN and SONS, Ltd., 86, St. Vincent-street, Glasgow. 5068 A

DRAUGHTSMAN, London, TEMPORARY, Experienced General Mechanical Engineering and Plant Lay-out. Works experience. State full particulars, age, salary required.—Address, 5057, The Engineer Office. 5057 A

DRAUGHTSMAN WANTED, One Accustomed to Structural Steel Work and able to take sole control of contracts.—Address, stating age, experience, and salary required, to NORTONS (TIVIDALE), Ltd., Hecla Works, Tipton, Staffs. 5066 A

DRAUGHTSMEN REQUIRED by Leading Oil Engine Manufacturers, capable of detailing Oil Engine Parts accurately and expeditiously. At least six months' employment to suitable men. State age, salary required, and when disengaged.—Address, 5064, The Engineer Office. 5064 A

LOCOMOTIVE DRAUGHTSMAN, Preferably with experience of Electric Locomotives, REQUIRED for the N.E. Coast. State age, experience and salary required.—Address, 5065, The Engineer Office. 5065 A

PLANT DRAUGHTSMAN WANTED; Good All-round man with experience of Hydraulic Machinery, Dies, Jigs and Tools.
Address, with full particulars of experience, age, and salary required, 5076, The Engineer Office. 5076 A

ROLLING STOCK DRAUGHTSMEN, Juniors, with experience of Electric Motor Coaches, REQUIRED for the N.E. Coast. State age, experience and salary required.—Address, 5086, The Engineer Office. 5086 A

TWO DRAUGHTSMEN WANTED IMMEDIATELY, accustomed to Automobile Engine Design.—Apply, stating age, experience and salary required, JAGUAR LTD., Shenstone, nr. Lichfield. 5084 A

FOREMAN BOILERMAKER WANTED; First-class all-round man with up-to-date experience of Water-tube Boilers, heavy and light plating.
Address, with full particulars of experience, age, and salary required, 5075, The Engineer Office. 5075 A

SITUATIONS WANTED

A SALES MANAGER (40), A.M.I.C.E., A.M.I.M.E., extensive administration experience, good London connection, heavy and light engineering, DESIRES NEGOTIATE CHANGE with progressive firm.—Address, P7043, The Engineer Office. P7043 B

ACCOUNTS, MANUFACTURER'S COST, STORES, &c., also SHORTHAND TYPIST. Last post 19 years with large food manufactory, now closed; age 44 years, married. POST SOUGHT in London or S. Eng.—Address, P6970, The Engineer Office. P6970 B

A.M.I. MECH. E., Shortly Disengaged, DESIRES POSITION as Manager of Factory; 8 years' experience of practical management, works, office and stores. Specialities: production and costs. Expert organiser.—Address, P7038, The Engineer Office. P7038 B

APPOINTMENT REQUIRED by Capable Organiser, at present holding responsible position as General Manager, with control of sales, finance and staff, in successful large industrial firm. The advertiser has a sound knowledge of marketing and business organisation and is thoroughly qualified to handle the sales or internal organisation of any industrial concern. He is not just looking for a "job." At the moment he is in receipt of ample remuneration, but he wants fuller scope. He would like to be associated with a progressive firm who could make adequate use of his undoubted abilities, and who could offer him the prospects for advancement which he now lacks. Would consider a colonial appointment. Responsible enquirers will be given full proof of his worth.—Enquiries should be addressed to Box ENERGY, W. C. Thorn, Ltd., 20, Kingsway, London, W.C. 2. 5079 B

SITUATIONS WANTED (continued)

C.E. and M.E. and SURVEYOR. Very Considerable experience, administerial, maintenance buildings, &c., SHORTLY AVAILABLE. Correspondence invited.—BM/KFDT, High Holborn, London. P7032 B

COMMERCIAL ENGINEER, Employed for the past 10 years in India and at present holding senior position in large general engineering concern, is compelled for private reasons to consider leaving India. Age 39, of good address, thoroughly familiar with commercial and manufacturing sides of engineering, as well as costing, sales and office and works management. Good organiser, possessing tact, initiative and ability to handle men. DESIROUS of OBTAINING SENIOR and PERMANENT APPOINTMENT offering prospects with established home firm.

Kindly communicate in first instance to P7007, The Engineer Office. P7007 B

COMPETENT EXECUTIVE, Experienced in the organisation and establishment of industries and works on production basis, DESIRES advantageous OFFER; exceptional record.—H. W., 40, Lebanon-road, Croydon. P6977 B

COSTING, STORES CONTROL, PLANNING, PROGRESS.—YOUNG MAN (single, 28) DESIRES CHANGE. Reorganisation or development work an attraction. Keen and energetic. Anywhere.—Address, P7055, The Engineer Office. P7055 B

ENGINEER (28) DESIRES APPOINTMENT. Public school, 3 years' apprenticeship, through foundry, pattern and machine shops, subsequently 3 years college, gaining Engineering Diploma and London B.Sc.

Last 4 years in charge of general engineering works, including structural yard. Unquestionable references Address, P7015, The Engineer Office. P7015 B

ENGINEER (26, Single), Experienced with Blast-furnaces and rolling mills, DESIRES a CHANGE. Willing to go abroad.—Address, P7067, The Engineer Office. P7067 B

ENGINEER (26, Single), with Wide Practical Experience of rolling mills, wiredrawing and general engineering, DESIRES APPOINTMENT. Now junior engineer to well-known firm.—Address, P7052, The Engineer Office. P7052 B

ENGINEER (29), Single, Public School Education, with varied experience in mechanical and structural engineering, and accustomed to outside erection, SEEKS RESPONSIBLE POSITION, home or abroad.
Address, P7022, The Engineer Office. P7022 B

ENGINEERING ASSISTANT (22), Good Education, DESIRES OPENING with Civil Engineers. Works, D.O., experience and technical training. Willing to go abroad.—Address, P7036, The Engineer Office. P7036 B

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For continuation of Small Advertisements see page 4.

A Seven-Day Journal

The Compressed Air Wind Tunnel at the N.P.L.

THE report of the National Physical Laboratory for the year 1929, issued this week, contains some news concerning the progress being made with the construction of the high-pressure wind tunnel for the Aerodynamics Department. As is well known, model tests yield results which must be interpreted in light of the Reynolds number appropriate to the conditions under which the tests are carried out. The Reynolds number is a factor portional to the linear dimensions of the model, to the velocity of the fluid in which it is tested, and to the density of the fluid and inversely proportional to the viscosity of the fluid. The theory is that model tests will yield results from which the full scale performance can be deduced if the Reynolds number for the model tests is the same as that for the full-scale conditions. In ordinary wind tunnel tests that equality does not hold. By carrying out the model tests in a current of high-pressure air a much closer correspondence is obtained. At present only one high-pressure wind tunnel exists in the world—in the United States. It is estimated that the new tunnel at Teddington, when it is completed, will enable wind speeds of 85ft. per second at a pressure of 25 atmospheres to be obtained, which will correspond with a Reynolds number 80 per cent. greater than that obtainable in the American tunnel. Even so, we believe, the Reynolds number realised will still be not much more than half that applicable to full-scale conditions. The construction of the tunnel has presented numerous points of difficulty, but most of them have now been successfully surmounted. The production of the steel shell for the tunnel has been entrusted to John Brown and Co., Ltd., of Sheffield, and has involved the rolling of rings 17ft. in diameter. The air will be supplied by a compressor and will be forced through the tunnel by means of a screw. Some idea of the magnitude of the forces involved in dealing with a current of air at a gauge pressure of over 350 lb. and travelling at nearly 60 miles an hour will be gained from the fact that the air screw required to maintain it will absorb 500 horse-power.

The French Motor Liner "Lafayette."

THE new French motor liner "Lafayette" called at Plymouth on the afternoon of Sunday last, May 18th, on her maiden voyage from Le Havre to New York. She is the largest French motor vessel afloat and was built for the North Atlantic service of the Compagnie Général Transatlantique by the Chantiers et Ateliers de St. Nazaire Penhöet. With her single tall mast and single low tapered funnel she presents an appearance pleasing and yet different from that of other ships of the French line. Her overall length is 610ft., her beam 77ft., her depth 50ft., and her measurement over 25,000 gross tons. Passenger accommodation is provided for over 1000 persons, including cabin, tourist cabin and third-class travellers, each group having well-designed public rooms and cabin accommodation. The propelling machinery consists of four sets of M.A.N. six-cylinder, two-stroke, double-acting oil engines, two of which were constructed by the builders and two at the Augsburg works of the M.A.N. company. The engines have a total rated output of from 16,000 to 18,000 S.H.P. at 145 r.p.m. and 150 r.p.m. respectively. The current for auxiliary lighting and power is provided by five oil-electric generator sets, three of which have a designed output of 700 kW and two an output of 500 kW. The deck machinery is operated on the Gilbert-Austin constant current system. On her recent trials the "Lafayette" attained a speed of 18½ knots, but in actual service she is expected to maintain about 17½ knots, making the crossing from Plymouth to New York in under seven days. The new motor liner will operate along with the 17,000-ton steamer "De Grass," built by Cammell, Laird and Co., Ltd., in 1924, for the special service of the French Line.

The Gibraltar Tunnel.

A STATEMENT made by the King of Spain to a French Press representative at the Railway Congress at Madrid to the effect that the Gibraltar tunnel will be constructed before the Channel Tunnel, has awakened the French to an appreciation of the importance to them of the Gibraltar undertaking. So long as the execution of the project appeared more or less problematical, there was no serious thought of the tunnel serving a useful purpose in facilitating communication between France and her African Colonies. Now that the King of Spain has given a positive assurance that the Gibraltar tunnel will be constructed as soon as the necessary funds are available, its value is beginning to be realised. There will be direct railway service to Casablanca. Most people travelling between France and Algeria will prefer to go by rail rather than make what is often a very disagreeable crossing of the Mediterranean. Moreover, the Gibraltar tunnel will obviously increase the value of the proposed Trans-Saharan Railway. It may therefore minimise the commercial value of the sea route between Marseilles and the North African ports, which are being developed at great expense to provide for future traffic, but the strategical importance of the sea route will remain so long as the Mediterranean problem is unsolved.

Improvements at Princes Dock, Liverpool.

ON Monday last, May 19th, members of the Mersey Docks and Harbour Board and other guests accepted the invitation of Sir Alfred Read, vice-chairman and managing director of Coast Lines, Ltd., to make a short cruise in the "Ulster Monarch," one of the three new motor vessels of the Ulster Imperial Line, in order to mark the re-equipping of the Princes Dock, Liverpool, for cross-Channel traffic at a cost of some £172,000. The entrance to the new dock has been increased from 46ft. to 60ft. and the sill deepened by 4ft., while the south entrance to the half-tide basin has been re-opened. In order to provide accommodation for the Dublin steamers, a new shed, 1570ft. long and 62ft. wide, has been erected on the east side of the dock and direct rail and road facilities provided. Provision is made for the erection of 5-ton roof cranes and a smooth level floor has been arranged. At the Belfast berth at the west side of the dock six electric transporter cranes have been installed. They have been specially designed to meet the requirements of the three new motor vessels of the Ulster Imperial Line. They have capacities of 5, 7 and 12 tons, the two smaller cranes serving the Nos. 1 and 2 hatches and the larger one the after hatch for heavy goods. Special grabs for motor vehicles have been provided and provision is made for raising the jibs to a vertical position to clear the ship's gear. The importance of the new cross-Channel terminal dock may be gauged from the fact that as many as nine cross-Channel steamers can berth at one time.

The Townend Ring.

WE are informed by Boulton and Paul, Ltd., of Norwich, that they now hold all the foreign and Dominion patents for the device known as the Townend ring, and that they have applications pending in this country and abroad for some important improvements on the original form of the ring. The device is the invention of Mr. Townend, an assistant in the Aerodynamics Department of the National Physical Laboratory, and the Crown, we gather, retains the right to the free use of the British and Dominions patents. The Department of Scientific and Industrial Research and Messrs. Boulton and Paul have entered into an agreement under which the firm will issue licences to British aircraft manufacturers to use the Townend ring on aircraft for sale either in this country or abroad. Responsible foreign applicants may also be granted licences for the manufacture and use of the device. The Townend ring is a cowl of short chord encircling the heads of the cylinders of radial air-cooled aero engines. On the outside it has a camber similar to that of the top surface of an aeroplane wing. Its object is to even-out the turbulent flow caused by the cylinder heads. Without the ring the effect of that turbulence is felt along the whole length of the fuselage and adds greatly to the natural drag of the body. With the ring the turbulence is reduced and the body drag is considerably lowered—by as much as 50 per cent. an aeroplane designer once told us. The reduction of the resistance, it would seem, surpasses that obtained with the complete cowling of the engine in the ordinary way—a curious result—and the ring does not prejudice the cooling of the engine or interfere with its accessibility, as does the usual cowling. The ring, it may be added, cannot be produced in a standard form, but must be designed to suit the particular type of engine and fuselage of the machine to which it is to be applied.

The New Landing Stage at Tilbury.

ON Friday of last week, May 16th, the new passenger landing stage at Tilbury was formally opened by the Prime Minister, the Rt. Hon. J. Ramsay MacDonald. The floating stage has a platform 1142ft. in length and 80ft. in width, which is carried on 63 pontoons. It projects into the river 370ft. in front of the original river bank, and is held against two timber dolphins, one near each end of the platform, by four hinged steel booms and heavy mooring cables, which allow it to rise and fall with the tides. Four bridges provide means of communication for passengers and luggage between the platform, the Customs and baggage hall, and the new railway station, and there is a fifth bridge for vehicular traffic. The baggage hall is constructed in brick on a reinforced concrete platform built on the foreshore of the river and it has a length of 295ft. with width of 72ft. and a height of 38ft. From the hall direct communication with the new L.M.S. railway station is provided. A length of 300ft. of the floating stage is reserved for the railway company's cross-river ferry service between Tilbury and Gravesend, so that the total length of the platform is 1442ft. On the liner portion of the landing stage there is a two-storey building 500ft. long, in which waiting-rooms, shelters and other accommodation are provided, whilst on the upper floor of the building there are covered gangways giving direct access to the vessel alongside. The whole of the work was carried out to the designs and under the supervision of Mr. Frederick Palmer, M. Inst. C.E., C.I.E., the consulting engineer to the Port of London Authority. The first ship to use the stage was the 16,500-ton P. and O. liner "Mongolia," which was followed on the Saturday by the P. and O. Australian liner "Balranald," the s.s. "Mantola," of the British India Line, and the Swedish Lloyd liner "Britannia," outward bound for Sweden.

The New White Star Liners.

AT the annual meeting of the White Star Line, Ltd., which was held on Friday last, May 16th, Lord Kylsant, the chairman of the company, made interesting reference to the new Atlantic liners which the company has on order. During 1929, Lord Kylsant said, though the sailings were somewhat reduced, the number of passengers carried by the "Majestic," "Olympic" and "Homeric" was fairly well maintained, but though the plans and arrangements for the construction of the new "Oceanic" were being prepared as far as possible, it had been decided to defer actively proceeding with the vessel for the present. The progress and development of varying types of marine propelling machinery was so rapid that it was considered to be of the utmost importance to give the fullest and maturest consideration to the design of the machinery for such a large and costly vessel. It was necessary that the new ship, when completed, should be pre-eminent, both in her speed and her equipment, and should be in a position to hold her own as an economic unit in the Atlantic trade. Lord Kylsant added that the new motor liner "Britannic," of 27,000 gross tons, was approaching completion at Harland and Wolff's Belfast yard and was scheduled to sail on her maiden voyage from Liverpool on June 28th. A sister ship was under construction at Belfast.

The Load Line Conference.

AN International Load Line Conference which has been convened by the British Board of Trade with a view to establishing uniform load line practice for the merchant ships of all nations was opened at the Foreign Office on Tuesday, May 20th. Representatives from some thirty-two nations were present and were welcomed by Mr. William Graham, the President of the Board of Trade. The chair was taken by Admiral of the Fleet Sir Henry F. Oliver, the Chairman of the British Delegation. That delegation includes Sir Charles Hipwood, of the Board of Trade; Sir Norman Hill, Chairman of the Merchant Shipping Advisory Committee; Sir Charles J. O. Sanders, Chairman of the Load Line Committee of 1927–1929; Captain F. W. Bale, of the Board of Trade; Mr. A. J. Daniel, of the Board of Trade; Captain J. T. Edwards and Captain A. Spencer, master mariners; Sir Ernest Glover, shipowner; Dr. J. Montgomerie, of Lloyd's Register of Shipping, and Mr. J. Foster King, of the British Corporation Register of Shipping and Aircraft; Mr. W. R. Spence, general secretary of the National Union of Seamen, and Mr. A. E. Lee, of the Board of Trade, who will act as the Secretary of the delegation. During the meeting a message was sent to his Majesty the King, who replied welcoming the delegates. In the evening the delegates were entertained to dinner by the Government and afterwards attended a Government reception at Lancaster House, St. James' Park.

The Zambezi Bridge and Railway Scheme.

DETAILS are now announced with regard to a provisional agreement which has been entered into to provide for the construction of a railway bridge over the river Zambezi, and an extension of the railway system so as to give a continuous railway line from Lake Nyasa to the Port of Beira. In order to carry out this scheme the existing Shire Highlands Railway Company and the Central African Railway Company are to merge their interests and to form a new single company, to be called the Nyasaland Railways, Ltd. The Nyasaland Government has agreed to provide the necessary capital for the scheme, which amounts to approximately £3,200,000, on condition that the amalgamation of the two interests above referred to is carried out. The new company will also create and issue sufficient debenture stock to cover the financial advances for the cost of constructing the bridge and of making the southern approach to it. The building of the Zambezi Bridge has been discussed since before the war, but owing to various difficulties no progress was made until quite recently, when plans were approved and preliminary constructional work embarked upon. It is expected that the carrying through of the new railway scheme and the replacement of the existing Zambezi River ferry by a railway bridge will prove of great advantage, both to the Government of the Nyasaland Protectorate and also to the Portuguese Government.

AGECROFT POWER STATION—20,000-kW TURBO-ALTERNATOR

THE METROPOLITAN-VICKERS ELECTRICAL COMPANY, LTD., WESTMINSTER, ENGINEERS

Extension of Agecroft Power Station.

THE Agecroft power station belonging to the Salford Corporation, the capacity of which has been recently increased, was originally opened in September, 1925. It was designed by Mr. J. A. Robertson, M.I. Mech. E., M. Inst. C.E., then Borough Engineer to the Corporation. The original scheme made provision for the installation of four main generating units, each of 12,500 kW, M.C.R., 3000 revolutions per minute, thus giving a total station capacity of 50,000 kW. The first three units were supplied by the Metropolitan-Vickers Electrical Company, Ltd., accommodation being provided for a fourth set with its complementary boiler units to be added at a later date. In the original scheme turbines of the single-cylinder type were decided upon, and for sets Nos. 1 and 2 unit cylinders were adopted. Subsequently, however, the two-cylinder type of turbine was introduced, and owing to its improved efficiency under high steam and load conditions it was decided to adopt that type for set No. 3, the change being amply justified by results.

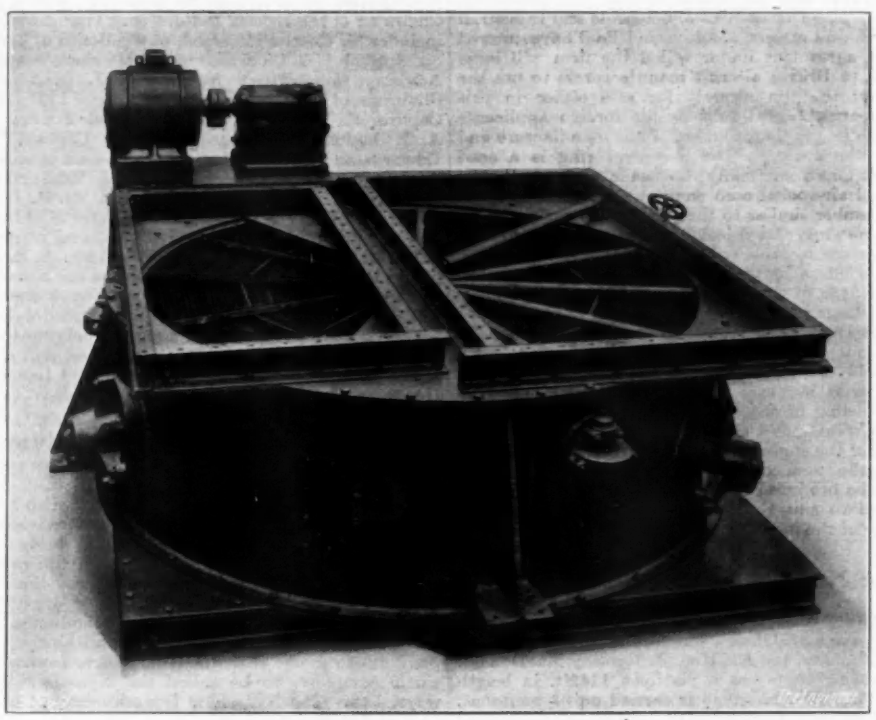


FIG. 1—HOWDEN-LJUNGSTROM AIR PREHEATER

The arrangement of the condenser auxiliary plant for these three sets is interesting, the circulating pumps, air extraction and condensate extraction apparatus being in duplicate. The two circulating pumps are each capable of performing 80 per cent. of the full duty. For starting purposes a two-stage steam-operated air ejector is employed, while for normal duty a Le Blanc rotary air pump coupled direct to an extraction pump and motor driven is used. In all cases the motors are of the direct-current type provided with current from an auxiliary supply. The site of the station was largely decided by its proximity to the river Irwell, the inky water of which is used for condensing purposes. As the summer flow of this river is, however, sometimes very low, a cooling tower plant was provided to cope with periods of drought.

The original boiler plant consisted of six Babcock and Wilcox units, and space was left in the building for a further two duplicate units when the fourth turbine set was laid down. The B. and W. boilers are of the marine cross-drum pattern, constructed for a normal working pressure of 325 lb. per square inch, with superheaters to raise the temperature of the steam to 720 deg. Fah. The normal output of each of these generators is 65,000 lb. of steam per hour with a maximum of 78,000 lb. per hour. Three of the boilers have B. and W. chain-grate stokers enclosed for forced draught and three have Underfeed A type louvre control for forced draught. The boilers operate under forced and induced draught. The feed apparatus comprises two steam-driven pumps of the Weir centrifugal type and two electrically-driven variable-speed centrifugal pumps, by Mather and Platt, Ltd.

The main transformers comprise ten single-phase units of the oil-immersed self-cooling type, by the Metropolitan-Vickers Electrical Co. They are shell-type units of 4667 kVA capacity, connected on three-phase banks of 14,000 kVA per bank, one single-phase unit being kept in reserve. The banks are star connected for 6600/33,000 volts, and each bank of transformers is connected direct on the primary side to the 6600-volt terminals of the alternator and to 33,000-volts switchgear on the secondary. For local service and for supply to the auxiliaries two three-phase transformers for stepping down from 33,000 to 6600 volts are provided.

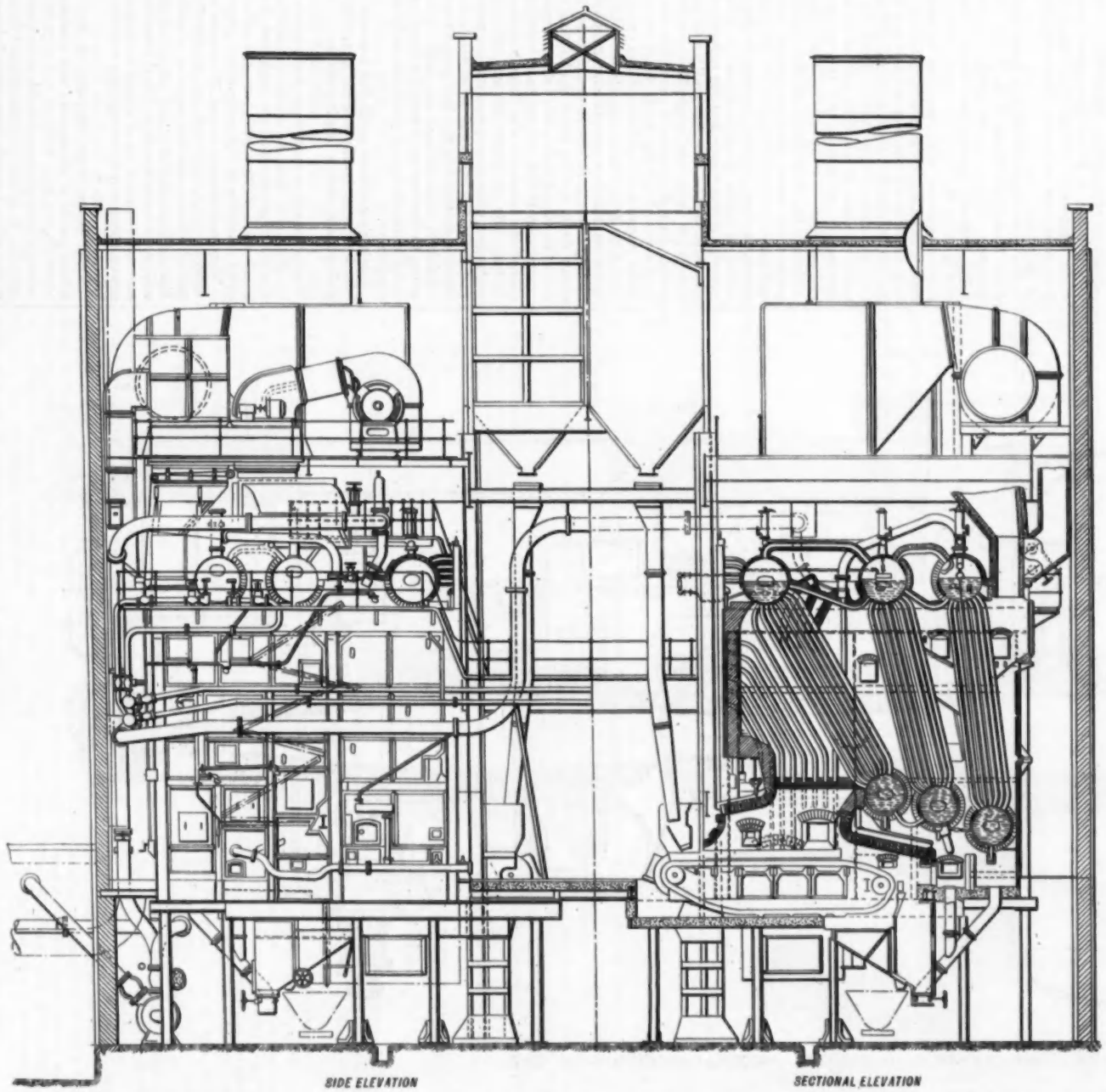
The switchgear, by the Metropolitan-Vickers Electrical Company, was one of the first in the country in which the switching is performed in the main 33,000-volt circuits, and the oil circuit breakers, having a short-circuit breaking capacity of one and a-half million kVA, were, at the time of their installation, the largest in this country.

FIG. 2—METRO-VICK CENTRAL-FLOW CONDENSER

The installation of the two-cylinder turbine for No. 3 set marked an improvement in the overall efficiency of the station, and in the report of the Electricity Commissioners for the year ending March, 1928, Agecroft headed the list of thirty-two stations in Class C with a thermal efficiency of 18·71 per cent. and the lowest coal consumption, namely, 1·60 lb. per unit generated. It should be emphasised that this station carries the full load of the city; hence it is not in such a favourable position as that of other highly placed stations where, by interconnection, one

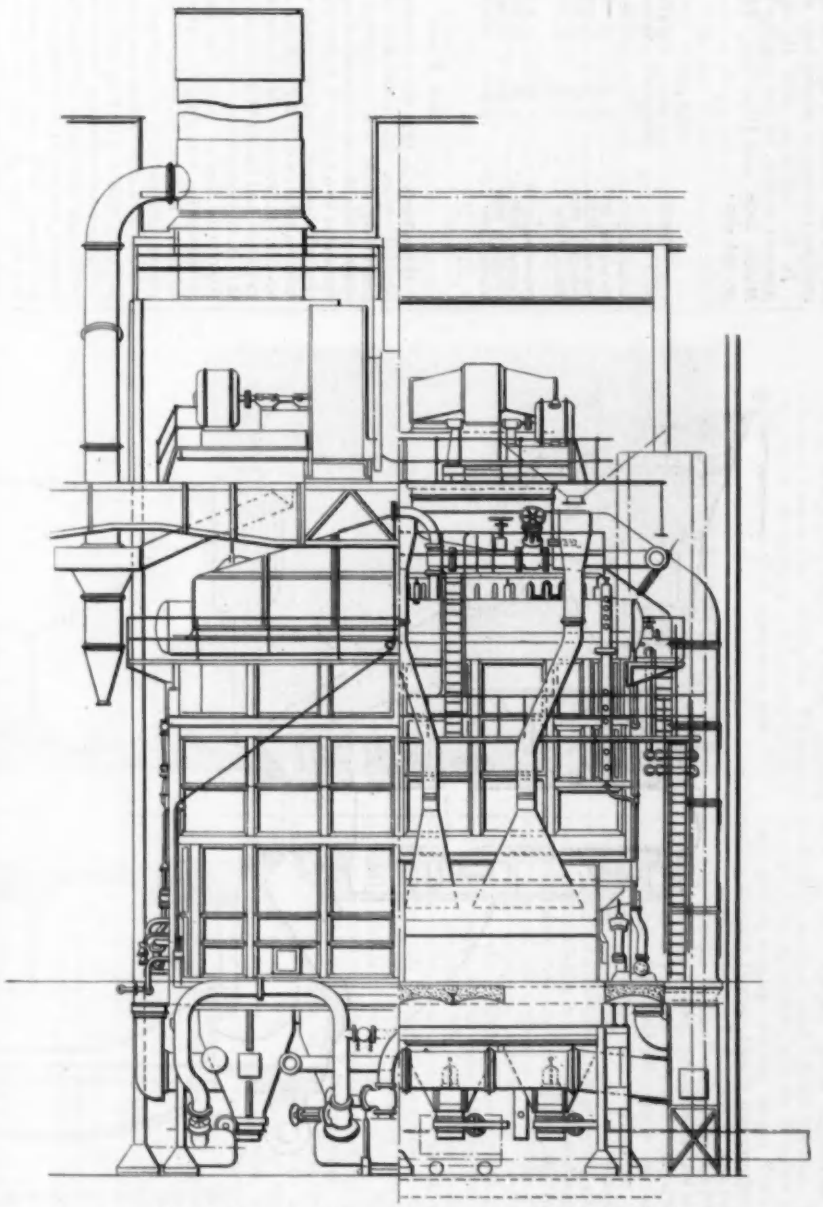
AGECROFT POWER STATION—EXTENSION BOILER-HOUSE PLANT

JOHN THOMPSON WATER-TUBE BOILERS, LTD., WOLVERHAMPTON, ENGINEERS



SIDE ELEVATION

SECTIONAL ELEVATION



HALF VIEW AT BACK OF BOILER

HALF VIEW FRONT OF BOILER

"THE ENGINEER"

AGECROFT POWER STATION EXTENSION—STEAM TURBINE FOR 20,000-kW TURBO-ALTERNATOR SET

THE METROPOLITAN-VICKERS ELECTRICAL COMPANY, LTD., WESTMINSTER, ENGINEERS

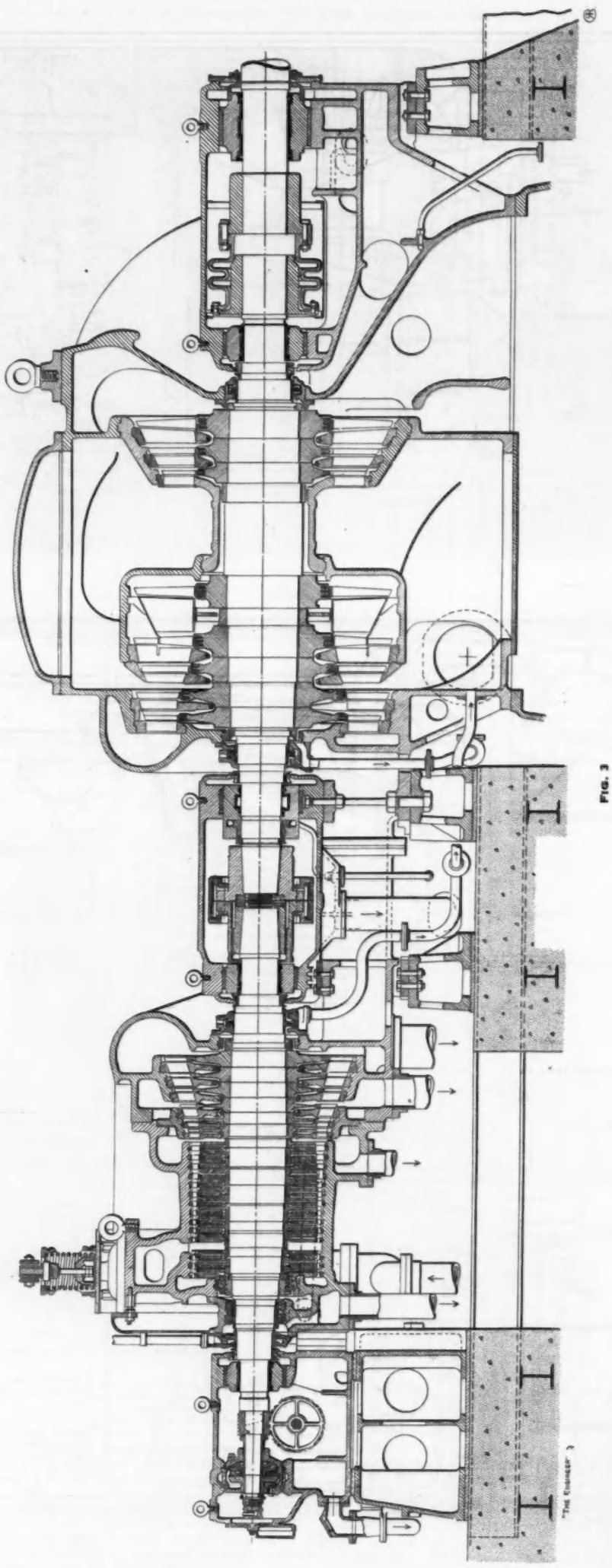


FIG. 3

station can be used to take the base load while other stations running in parallel take the peak.

In the following table the operating results of Agecroft station for the months December, 1927, to March, 1928, and December, 1928, to March, 1929, are set out :—

Month.	Coal per unit generated, lb.	Calorific value, gross.	Boiler-house efficiency per cent.	Thermal efficiency, per cent.
December, 1927 ..	1·53	11,300	76·4	19·75
January, 1928.. ..	1·51	11,049	79·0	20·46
February, 1928 ..	1·51	11,307	76·8	20·00
March, 1928	1·52	11,427	75·5	19·65
December, 1928 ..	1·54	11,417	75·3	19·40
January, 1929 ..	1·52	11,485	75·7	19·56
February, 1929 ..	1·53	11,090	77·4	20·13
March, 1929	1·60	10,828	76·9	19·73

NEW PLANT.

When early in 1928 the extension of the station was decided upon, the possibility of installing larger generating units was considered, and although the space available was originally designed for 12,500-kW units and two boilers of 65,000 lb. evaporative capacity, after careful consideration it was found that with minor alterations of the building a scheme drawn up by Mr. L. Romero, M.I.E.E., the City Electrical Engineer, and his staff for the provision of a 20,000-kW M.C.R. turbo-generator unit and two boilers, each of 100,000 lb. normal rating and an overload capacity of 120,000 lb., was possible. The station, which was originally laid out for 50,000 kW, has thus been converted into one with a capacity of 57,500 kW. Illustrations of the new boilers are given on page 567 and in Fig. 5, while the turbo-generator is seen on page 566.

The normal operating conditions of these two new boilers are as follows :—When burning coal with a calorific value of 10,500 B.Th.U. to 12,000 B.Th.U. per pound, with feed water supplied at 100 deg. to 212 deg. Fah. and with air for combustion at a temperature of 250 deg. to 270 deg. Fah., each boiler is capable of evaporating 100,000 lb. of water per hour at a pressure of 325 lb. per square inch with a final steam temperature of 780 deg. Fah. at the stop valve. The guarantees are to be obtained on the lower figures in each case.

The new steam generating plant was supplied by John Thompson Water Tube Boilers, Ltd., Wolverhampton. Each boiler comprises three banks of tubes disposed between six drums, three at the top and three at the bottom. Each series of tube banks is connected one with the other by means of several short circulating tubes between the drums, whilst the long tubes which connect the top and bottom drums are set vertically. By this means the water fed into the rear steam drum passes down the back row of tubes, the area of which is such as to give a velocity varying in proportion to the evaporation. The makers claim that owing to the comparatively small difference in temperature at this point between the gas and the water, and the gradual rise of the water, suspended matter is deposited in the rear drum, thus preventing the deposit of scale in any of the other drums or banks of tubes where the greater temperature rise of the water and big differences in the temperatures of the flue gas and water would tend to form scale from any suspended matter in the feed water. The circulation is then from the bottom back mud drum to the top back steam drum, whence the water passes to the middle steam drum by means of short connecting tubes down to the middle mud drum, up to the middle steam drum, through the short connecting pipes to the front steam drum, from the front steam drum to the front mud drum and from the front mud drum to the front steam drum. To accommodate the water circulation at varying loads short connecting tubes are also fitted between all the mud drums. The gas passes are arranged so as to be in a contraflow direction to the water passes. It will be seen from the sectional illustration that the baffle tiles are arranged in the last pass so as to obtain the maximum separation of the grits from the flue gas owing to the sudden change in direction of the gases and the ample space provided underneath the rear mud drum.

Each steam drum is 3ft. 9in. internal diameter and 36ft. long, with banks of tubes 3½in. external diameter, giving altogether a heating surface of 14,300 square feet. It may here be mentioned from one of the illustrations that each drum is made of a single length of plate, in order to avoid circumferential seams. The heating surface of the back row of tubes referred to above is 6500 square feet, the tubes being of the same diameter as the boiler tubes proper.

The superheaters are of Thompson's U-tube convection design, and each has an effective heating surface of 4500 square feet made up of cold-drawn tubes, 1½in. internal diameter, and expanded into rectangular solid drawn steel headers. The side walls of the furnaces are water cooled by a simple arrangement of solid-drawn tubes which are partially embedded in the fire-bricks.

This design was adopted by the makers after a long period of experiment and research, and we are informed the first walls of this type installed in this country have given no trouble after years of continual service. It should be pointed out that the circulation of the water through these tubes is independent of the

water circulation in the boiler itself, and is simply an upward flow direct from the mud drums to the steam drums. The tubes are expanded into solid-drawn steel headers, and it will be seen from the illustrations that advantage has been taken of this arrangement to eliminate the necessity of slicing the side walls of the furnace, the lower water wall headers being arranged just above the stokers for this purpose.

The arches are of the Detrick suspended type, and they and the combustion chamber generally, have been designed to ensure efficiency of combustion, having regard to the quality of fuel to be used. In this connection it should also be mentioned that the boilers are fitted with twin stokers of the Underfeed Stoker Company's "L" louvre or compartment type, with air control valves. The total grate area is 420 square feet, and each grate is separately driven by a variable-speed direct-current motor, in addition to which gearing is provided to give variations of speed. The chief claims for this type of stoker are:—The control of the air at practically any position of the stoker; ease of replacing broken fire-bars without stopping; and the reduction of the riddlings.

Each boiler is equipped with a Ljungstrom preheater, made by Howden-Ljungstrom Preheaters (Land), Ltd. They are of the makers' standard size, and are designed to deal with the whole of the flue gases and the air for combustion. On normal load the flue gas temperature is reduced from 420 deg. to 267 deg. Fah., and the combustion air is heated from 70 deg. to 250 deg. Fah. On maximum load the corresponding temperatures are 470 deg. to 304 deg. Fah. and 70 deg. to 267 deg. Fah. respectively. The preheaters, one of which is illustrated in Fig. 1, are constructed on the regenerative principle, and are of the contraflow type. The illustration shows the exit flue gas and air inlet connections, also the rotor which contains the heating elements. The flue gases pass upwards through the apparatus, while the air passes in the opposite direction, and the heat is transferred from the flue gas side to the air side when the rotor revolves. The heat is not transferred through metal, but is carried over in the mass of regenerative elements, and the preheater acts as a continuous regenerator. The heating surface is formed of corrugated and undulated steel sheets which are not riveted or welded, but only packed loosely in the rotor. The gas and air pass through the spaces formed by the corrugations, and the insertion of the undulated plates has the effect of contracting and expanding the gas or air and imparting to them a turbulent flow. Stationary soot blowers are fitted at the top and bottom of the preheaters, and as the rotor revolves the entire heating surface is swept by the steam jet during each revolution of the rotor. The weight of the rotor shell and heating elements is carried on three rollers, and, in addition, guide rollers are fitted which maintain the rotor in the horizontal plane.

The forced and induced draught plant was supplied by Davidson, Ltd., the induction fan being designed to give a draught of approximately 5in. w.g., and the forced draught fan 6in. w.g. In each case the fan is driven by a 440-volt, 50-period, three-phase, alternating-current motor. These motors are an innovation in the boiler-house, as all the existing motors were of the direct-current type working at 220 volts. The chimneys were built by John Thompson (Dudley), Ltd., and are 8ft. 6in. in internal diameter. They are 100ft. high from the firing floor level. Having regard to the expected high efficiency of the boilers and the subsequent low temperature expected at the chimney base, it was decided that the grit arresters and the chimneys should be lined internally with reinforced concrete.

The steam receiver is 4ft. internal diameter by 15ft. long, and is a solid forging with a manhole at each end, and the necessary mountings rivetted on. The valves throughout are of the solid-forged "Victory" pattern made by Victory Valves, Ltd., Stockport. No alteration was required to the existing coal and ash-handling plant, with the exception of the necessary coal chutes

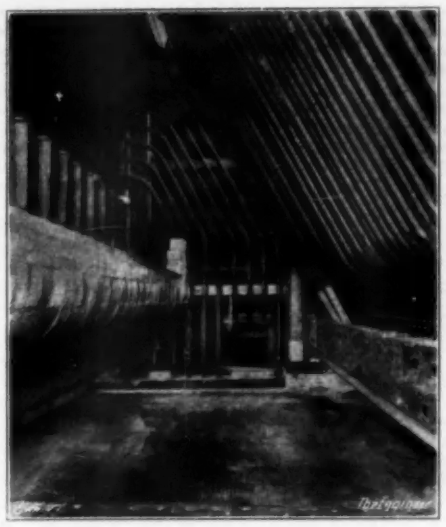


FIG. 5—COMBUSTION CHAMBER OF THOMPSON BOILER

from the bunkers to the stoker and ash hoppers and chutes to the water trough shown on the general arrangement drawing.

The following are the leading particulars of the 20,000-kW turbo-alternator set, which was supplied by Metropolitan-Vickers Electrical Company, Ltd.:—

Maximum continuous rating	20,000 kW
Economical rating	16,000 kW
Speed	3,000 r.p.m.
Steam pressure	300 lb. g.
Steam temperature	700 deg. Fah.
Vacuum at economical load	29in.
Alternator characteristics—	
Voltage	6,600
Periodicity	50
Phase	3
Turbine—	
Type	Two-cylinder impulse
Feed heater stages	Two low-pressure stages plus one gland heater
Final feed temperature at economical load	200 deg. Fah.
Condenser—	
Maker	Metropolitan-Vickers Electrical Company
Type	"M.V." central flow
Cooling surface	24,000 square feet
Circulating water	13,500 gallons per min.
Inlet water temperature	55 deg. Fah.
Air pump—	
Normal duty	One Leblanc rotary air pump
Starting and stand-by	One two-stage air ejector
Extraction pump—	
In duplicate each	100 per cent. capacity

With regard to the auxiliaries in the original design direct current was adopted throughout, necessitating, of course, a direct-current house set and conversion by means of motor generators from alternating current to direct current, the intention being to continue the direct-current system in the future for auxiliary service. In order to avoid a costly extension of the direct-current converting plant, it was decided to drive the additional boiler-house auxiliary plant with alternating-current motors, and to split the drive on the turbine house auxiliaries between alternating current and direct current, the only additional direct-current motors installed being the small motors required for the stoker drive and the spare extraction pump. One of the circulating pump motors is also direct-current, but it was taken from one of the pumps on No. 3 set, which was fitted with a new alternating-current motor, with the result that both Nos. 3 and 4 sets have each one alternating-current and one direct-current motor on their circulating pumps. It was also decided, in order to minimise the risk of disturbance from outside causes on the system, to provide a low-pressure alternating-current switchboard with duplicate busbars, so that the auxiliaries may be run either off the station busbars or off the terminals of the new alternator through the stepdown transformer. Starting up is effected on the direct-current circulating and extraction pumps and the steam air ejector, and after the set is paralleled on the station busbars, the alternating-current auxiliaries are run up from the machine terminals through the stepdown transformer. The direct coupling of the alternating-current motors to the alternating terminals without automatic tripping ensures that the operation of the pumps is not affected by external line disturbances.

The exhaust stages of the turbine comprise a Baumann multi-exhaust combined with a divided flow arrangement. The steam, after leaving the second stage of the low-pressure cylinder, is divided, part being led by channels formed in the casing over to three stages at the extreme end of the turbine, whence it passes to the condenser. The other portion of the steam passes through a single impulse stage and then enters a Baumann duplex exhaust stage, and thence to the condenser. Thus the final expansion of the steam may be said to be distributed over three groups of final blades, enabling a very large leaving area to be employed with a correspondingly low leaving loss. The official tests carried out show that at normal rating the condensate temperature was less than 1 deg. below that of the exhaust steam.

The step-up transformers raising the alternator pressure of 6600 volts to the transmission pressure of 33,000 volts, consist of two M.V. delta-star connected, three-phase, 12,500-kVA units in parallel. These transformers are of the outdoor self-cooled type.

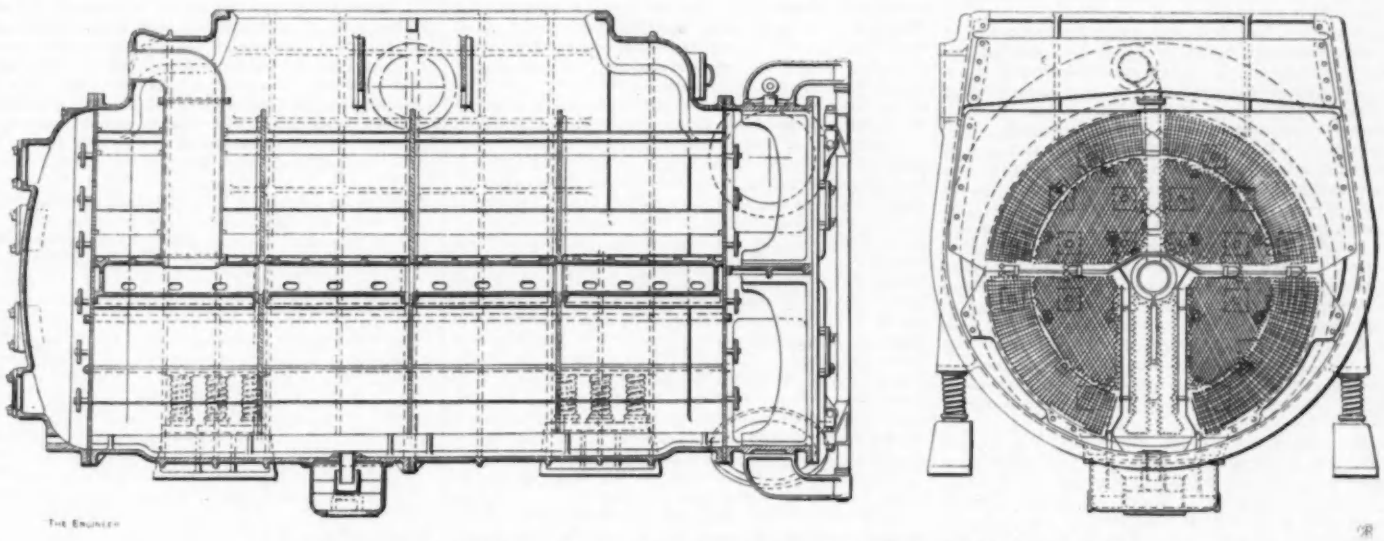


FIG. 4—SECTIONS THROUGH METRO-VICK CENTRAL-FLOW CONDENSER FOR 20,000-kW TURBINE

The Automatic Stabilisation of Ships.

No. VIII.*

IN the preceding article it was shown that a gyroscope oscillating through a range $\pm\alpha$ about the vertical position in the same period T as the period of the waves is capable of fully stabilising a ship, provided the rate of precession is controlled. It was shown that the general nature of the precessional control required is a retardation while the gyroscope is tilting forward or aft away from the vertical, and an acceleration while it is recovering the vertical position from the extreme forward and aft tilts, $+\alpha$ and $-\alpha$. We have now to study in greater detail the nature and magnitude of the required retardation and accleration of the precession and to investigate to what extent the oscillating gyroscopic system is, or can be made, self-adjusting in order that it may give complete stabilisation to the ship when the magnitude of the waves varies.

It is not a difficult mathematical problem to arrive at an exact expression for the retardation or assistance which must be provided for the precession at any given instant in order that the precession may be

* No. VII. appeared May 16th.

controlled to the rate requisite to give complete stabilisation. A complete mathematical demonstration would, however, prove unconvincing to many readers. It is proposed, therefore, to give a simple approximate solution of the problem, which has the merit of enabling us to appreciate the factors involved without the necessity for studying and interpreting involved formulæ.

Let us suppose that the vessel is fitted with a gyroscope of polar moment of inertia I and spinning with a constant speed $\dot{\theta}$ on its axle. It is necessary to introduce a third factor connected with the design of the gyroscopic equipment, namely, its moment of inertia about the transverse, or precessional, axis. If the gyroscopic equipment could be regarded as consisting of nothing but the disc, this second, or diametral, moment of inertia would be just half the polar moment I. Actually, however, the gyroscopic equipment includes the frame or casing in which the disc is mounted and an electric motor, or other means of driving the disc. The frame, &c., precess with the disc and their moment of inertia about the precessional axis must be added to the diametral moment of the disc. It makes no difference to our general argument what value we assign to the moment of the complete equipment about the precessional axis, although it is necessary to avoid the mistake of assuming that it is half the polar moment of the disc. We will designate it I′, where I′ is some quantity greater than I/2.

The vessel is to be supposed as encountering a train of sine-form waves of period T and as being fully stabilised by means of her gyroscopic equipment. The heeling moment acting on her at any instant t will then be $K \cos 2\pi t/T$. In this expression the quantity K, as we have previously shown, has the value $\frac{1}{12} \frac{w b^2}{d} \frac{\pi H}{L}$, and, therefore, for a given ship varies directly with the ratio of the height H of the waves to their length L. We may, therefore, write $C r$ instead of K where C is a constant for a given vessel and r is the height-length ratio of the wave train to which she happens to be exposed.

At zero time, that is to say, when the first wave of the train reaches the side of the vessel, the heeling moment will have the maximum magnitude K or $C r$. The axle of the gyroscope at this instant being vertical, the gyroscope will begin to precess with an angular velocity about the athwartship axis, the top end of the axle moving forward if the spin of the disc is in the direction previously shown, and if the wave train is received on the port side of the vessel. The value of this initial precession will, as we know, be given by $\phi = K g/\dot{\theta} I = C r g/\dot{\theta} I$, and will be just sufficient to generate a gyroscopic reaction that will balance the heeling moment, and for the instant completely stabilise the ship. It will be noted that, the speed of spin $\dot{\theta}$ of the gyroscope being taken as invariable, the initial precessional velocity will vary directly with the height-length ratio r of the waves and, therefore, that the initial counteraction applied by the gyroscope will be automatically adjusted to the magnitude of the heeling moment applied by the waves.

At the end of the first quarter period the heeling moment will have fallen to zero. At this instant, as we have seen, the requirement for complete stabilisation is that the gyroscope should be at the extreme forward end α of its tilt and should momentarily be stationary. The retardation to be applied to the precession is, therefore, such as will reduce the precessional velocity from the initial value $C r g/\dot{\theta} I$ to zero in the time T/4. At the beginning of the second quarter period the heeling moment is zero and the gyroscope is momentarily stationary at its extreme angle α of forward tilt. At the end of the second quarter period the heeling moment has the initial maximum value, but is reversed in direction. To counteract it the gyroscope should again be vertical and be tilting with the initial velocity, but backwards instead of forwards. The acceleration of the precessional velocity required during the second quarter period is, therefore, such as will cause the precession to increase from zero to $C r g/\dot{\theta} I$ in the time T/4.

Similarly, in the third quarter period the retardation required is such as will reduce the precessional velocity in the backwards direction from the value $C r g/\dot{\theta} I$ to zero in the time T/4. In the fourth quarter period the acceleration required is such as will increase the precession from zero to the value $C r g/\dot{\theta} I$ in the forward direction, the time occupied by the increase again being T/4.

We are now, it will be noted, getting away from the conditions specified in article No. V., in which we established the fundamental gyroscopic formula $M = \dot{\theta} \phi I/g$. That formula, it was pointed out at the time, was strictly applicable to the case in which the precessional velocity ϕ is constant. We are now dealing with a case in which ϕ, instead of being constant, is required to fluctuate rhythmically between a maximum value $C r g/\dot{\theta} I$ in one direction to an equal maximum value in the opposite direction. Investigation is clearly necessary in order to determine how far the formula arrived at for ϕ constant is applicable if ϕ is variable.

A method of carrying out this investigation is indicated in the mathematical note appended to article No. V. Here we propose only to state the result obtained. It is found that the expression $M = \dot{\theta} \phi I/g$ is still applicable as giving the gyroscopic reaction developed by the disc about its diametral axis V V—see Fig. 22—that is to say, if ϕ is variable, the gyroscopic reaction will vary strictly in keeping with it. It is also found that if ϕ is variable there must be in existence not one but two external moments, namely, one acting about V V, as before, to balance the gyroscopic reaction, and a second one acting about the precessional axis X X. The external moment M_v about V V being required to balance the gyroscopic reaction, has the value $\dot{\theta} \dot{\phi} I/g$, and is therefore variable since ϕ is variable. The external moment M_x about the precessional axis is, it is found, precisely equal to that which would be required to produce the variation in ϕ if the disc were not spinning. With these two external moments in existence the gyroscope will react against the external moment

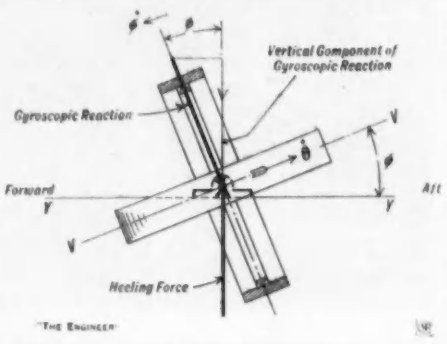


FIG. 22—(REPRODUCED)

acting about V V and will preserve its precessional axis X X horizontal.

This result may appear at first sight to contain a contradiction. An external moment applied about a diameter V V of a spinning disc produces, as we know, movement or precession of the disc, not about the diameter V V, but about another diameter X X at right angles to V V. The second external moment M_x acting about X X ought therefore, it would appear, to produce motion of the disc about V V. Actually, as we have said, it imparts motion to the disc about X X just as it would do if the disc were not spinning. In other words, the moment M_x may be said to act non-gyroscopically on the spinning disc. The explanation is clear on a little reflection. The external moment about V V produces motion of the disc about X X in accordance with the relationship $M_v = \dot{\theta} \phi I/g$, if, and only if, the disc is free to rotate about the axis X X. The moment M_x does not produce rotation about V V, because the disc is not free to rotate about V V. By supposition the gyroscopic reaction about V V has been balanced by the first external moment, and the precessional axis X X has therefore been stabilised. The disc cannot turn about the diameter V V as axis if the precessional axis X X is stabilised. Hence the second external moment M_x cannot act gyroscopically on the disc. Its action is confined to turning the disc about X X, just as it would do if the disc were not spinning.

We can apply this result to the stabilisation of ships by taking either the heeling moment acting about Y Y or the precessional velocity ϕ or the second external moment M_x as our starting point. Perhaps the most direct method is to begin with the second external moment. Let us suppose that a moment M_x is applied to a spinning disc about a diameter X X. This diameter is to be taken as being fully stabilised since our object is to discover the conditions existing in a fully stabilised ship on which X X is mounted transversely. No motion of the axis X X being permissible or possible, the moment M_x will act on the disc non-gyroscopically, and will set it in motion about the axis X X with a velocity ϕ, which will be variable, the exact value of ϕ at any instant depending upon the magnitude of M_x, and whether it is constant or otherwise. At any given instant the moment M_x will have tilted the gyroscope about X X to some angle φ, and will have impressed on it an angular velocity having momentarily some value ϕ. The gyroscopic reaction of the disc corresponding to this velocity ϕ will take place about the diameter V V, and in amount will be given by $\dot{\theta} \phi I/g$. The vertical component of this reaction will be $\dot{\theta} \phi I \cos \varphi/g$, and will act about Y Y. This component has for complete stabilisation of the ship just to be equal to the heeling moment acting on the vessel at the given instant. It is evident then that the solution of our problem is to adjust the second external moment M_x in such a way that it will produce the velocity about X X required at each and every instant to give the desired value of the vertical reaction.

If the gyroscope is vertical at zero time, then the value of the heeling moment in action on the fully stabilised ship at any instant t after zero time, will, in the symbols already employed, be $C r \cos 2\pi t/T$, and therefore the general equation for complete stabilisation is—

$$\dot{\theta} \phi I \cos \varphi/g = C r \cos 2\pi t/T$$

This equation contains within it practically everything which we desire to discover. It can be employed, for example, to deduce the value of the precessional velocity at any instant, the angle of tilt at the same instant, and the value of the second external moment which must instantaneously be in action about the precessional axis X X. It tells us also the angle through which the gyroscope will oscillate under given wave conditions, and how that angle will vary when the wave conditions change. It can be used to prove that the Schlick system in which the second external moment was given by means of a fixed weight attached to the gyroscope frame cannot fulfil the conditions for complete stabilisation under other than one size of wave, and even then can only do so approximately. These and other matters are all implicit in the general equation, but the method of deducing them from it is purely mathematical, and the expressions arrived at are complicated and not very readily interpretable. We can obtain very close results of the right order and in the correct direction by a simpler investigation.

We already know something about the second external moment required to give complete stabilisation. It has been shown that at zero time the heeling moment acting on the gyroscope—at this instant vertical—will impress on it automatically the precessional velocity required to give the correct reaction without assistance or retardation. The second external moment M_x or precessional moment, as we will now call it, should therefore be zero at zero time. The initial precessional velocity $C r g/\dot{\theta} I$ has to be reduced to zero in the first quarter period T/4. This reduction has to be effected by the precessional moment. It is evident, therefore, that that moment is one which starting from zero at zero time increases in magnitude up to the time T/4. Because it has to oppose the initial velocity which is in the forward direction, the precessional moment during the first quarter period is evidently such as would, if the gyroscope were not tilting forward under the influence of the initial precessional velocity, tilt it aft. During the second quarter period the precessional moment has to assist the gyroscope to tilt aft. It therefore is not required to reverse its direction at the instant T/4, but it must clearly now begin to fall in amount in order that it may disappear completely at the instant T/2, when the gyroscope is again vertical and when the heeling moment without assistance is once again able by itself to impress on the gyroscope the precessional velocity requisite for complete stabilisation.

Continuing the argument into the third and fourth quarter periods, we deduce that the precessional moment required may be represented in general outline by the curve shown at A in Fig. 26. Let us then

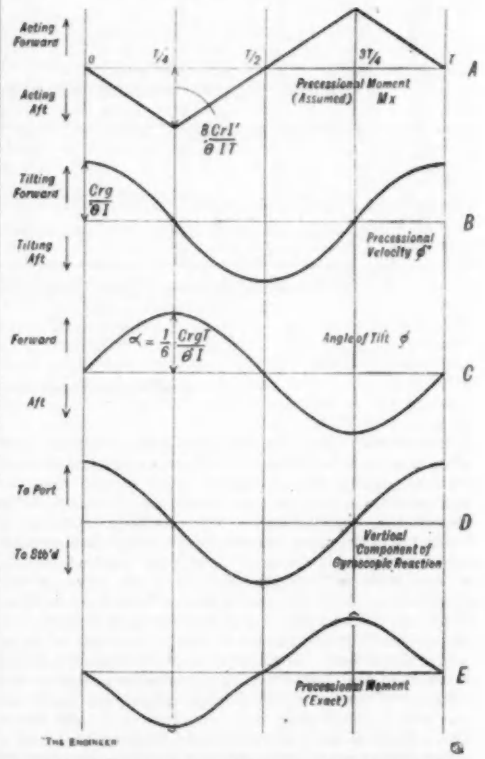


FIG. 26—PRECESSIONAL MOMENT AND RESULTANT REACTION

take it that the precessional moment is one which rises and falls at a uniform rate in the manner shown by this curve.

During the first quarter period, the precessional moment may be expressed in symbols as $M_x = P t$, where P is a constant and t is the interval of time which has elapsed from the zero instant. If I′ is the moment of inertia of the disc and its casing or frame about the precessional axis, then this variable moment M_x will in accordance with familiar dynamical principles impress on the disc an angular velocity at a time t given by $\frac{1}{2} P t^2 g/I'$. This velocity is opposed to the initial precessional velocity $C r g/\dot{\theta} I$ of the disc. Hence at the end of an interval t the disc will be tilting forward with an actual velocity given by $\dot{\phi} = C r g/\dot{\theta} I - \frac{1}{2} P t^2 g/I'$. It is necessary, as we have seen, that the moment M_x should be such that the

initial precessional velocity should be reduced to zero in the time T/4. We must therefore have :—

$$0 = C\,r\,g/\dot{\phi}\,I - \frac{1}{2}\,P\,(T/4)^2\,g/I',$$

which gives us $P = 32\,C\,r\,I'/\dot{\phi}\,I\,T^2$. It follows, then, that in order that the moment M_z may reduce the initial precessional velocity to zero in the time T/4, it should rise during the quarter period from zero to a maximum value of $8\,C\,r\,I'/\dot{\phi}\,I\,T$.

Again, from familiar dynamical principles, if the precessional velocity ϕ at any instant is as given above, then the angle of tilt acquired by the gyroscope at any instant t will be given by—

$$\varphi = \frac{C\,r\,g\,t}{\dot{\phi}\,I} - \frac{1}{6}\,\frac{P\,t^3\,g}{I'}$$

We may write this, using the value of P just found, as

$$\varphi = \frac{C\,r\,g}{\dot{\phi}\,I}\left(t - \frac{16}{3}\,\frac{t^3}{T^2}\right)$$

Hence, at the instant T/4 the tilt of the gyroscope will be—

$$\alpha = \frac{1}{6}\,\frac{C\,r\,g\,T}{\dot{\phi}\,I}$$

In Fig. 26, curves B and C show respectively the precessional velocity and the angle of tilt of the gyroscope at all instants, as determined in this manner from the curve A of precessional moments.

Knowing the precessional velocity and the angle of tilt, at each and every instant, we can now determine the corresponding instantaneous value—

$$\ddot{\phi}\,\dot{\phi}\,I\cos\varphi/g$$

of the vertical component of the gyroscopic reaction. The result of this determination is indicated by the curve D.

On the assumption, then, that the precessional moment required is of the simple form shown at A, the curve D respresents the moments which the gyroscope applies to the ship to counteract the heeling forces of the waves. For complete stabilisation the vertical reaction of the gyroscope ought at each and every instant to be exactly equal to the heeling moment applied to the ship by the waves. In other words, if our assumption as to the form of the curve A is correct, curve D ought to represent with precision the heeling moments of a sine-form wave, namely, $H.M. = C\,r\cos 2\pi t/T$. On examination it is found that the agreement between curve D and the heeling moments given by this expression is so close that it is impossible to represent the difference on the scale to which the diagram is drawn. We therefore conclude that the precessional moment required is very closely represented by the simple form given to it in curve A.

It is quite possible to start with the exact curve of the heeling moments applied by the waves, and, taking it as D, to work backwards through C and B, and so arrive at the exact curve of precessional moments required. The process involves mathematical analysis. When it is carried out the exact precessional moment curve is found to be that represented by E. Except for the fact that the peaks of this curve are rounded off, it superposes on our assumed curve A almost with complete exactitude.

Mathematical Note.—The approximate formulæ for the maximum angle of tilt $\alpha = 1/6\,C\,r\,g\,T/\dot{\phi}\,I$ and for the maximum value of the precessional moment $M_z = 8\,C\,r\,I'/\dot{\phi}\,I\,T$ may be compared with the mathematically exact formulæ. From expression (6) in the note accompanying article No. VII., we have $\sin\alpha = n/B = K\,g\,T/2\,\pi\,\dot{\phi}\,I = C\,r\,g\,T/2\,\pi\,\dot{\phi}\,I$. The approximate formula for the angle of tilt, therefore, differs from the exact by substituting α for $\sin\alpha$ on the left-hand side and by substituting $1/6$ for $1/2\,\pi$ on the right-hand side. The approximate and the exact formulæ for α will be in agreement for $\alpha/\sin\alpha = 2\,\pi/6$, which holds for $\alpha = 30$ deg. From expression (8) in the previous note we have :—

$$\ddot{\varphi}_{max} = -\frac{n\,B^2}{\sqrt{(B^2 - n^2)}}$$

from which it follows that the mathematically correct value of the maximum precessional moment $\frac{I'\,\ddot{\varphi}_{max}}{g}$ is $\frac{2\,\pi}{\sqrt{(1 - n^2/B^2)}}\cdot\frac{C\,r\,I'}{\dot{\phi}\,I\,T}$. Hence the approximate and exact formulæ for M_z will be in agreement, for $n/B = 5/8$, *i.e.*, for $\alpha = 39$ deg. For $\alpha = 30$ deg. the exact value of M_z will be 0·907 times the value given by the approximate formula. It will be noted that the agreement between the approximate and the exact formulæ in both cases is dependent solely upon the value selected for the maximum angle of tilt of the gyroscope. The curves in Fig. 26 have been calculated on the basis of this angle being 30 deg.

(To be continued.)

WE have been led, by a remark by Mr. Whitelaw, that the London and North-Eastern had decided that it was necessary to spend a considerable sum in bringing the company's hotels up to the standard of convenience which was now demanded, to see how the results of the hotel and refreshment rooms business by railway companies stand to-day. We find that there was a decrease of £371,020 in the profits of the four grouped companies in 1929, as compared with 1924. The Southern made only £505 profit last year, but it must be remembered that its business is done wholly by contract.

Flowing Water.

By J. M. LACEY, M. Inst. C.E.

No. I.

RIVERS are natural channels conveying water which drains off their hydrographic basins to their ultimate destination, the sea; or, in nearly rainless regions of internal drainage, into dwindling, salt lakes. The section and inclination of such channels vary within limits of considerable range, and the volume of water they carry, and the nature of its movements are proportionately affected by such variations.

For the present purposes, it will be sufficient to consider the fluviatile compartment of rivers, as distinguished from their tidal compartments. They present a water section which increases more or less regularly in their course to the sea, and in longitudinal section they present concave curves both at bed line and at the surface. The curve of their bed line where they debouch from the hills, to their estuaries, tends to become parabolic, while the slope of their water surfaces is not always concentric, or parallel, to their bed line.

The velocity of the water in a river would continually accelerate independently of the variation in volume, if the resistance of the bed and sides of the channel, by inducing turbulent motion, did not exercise a retarding influence. Again, if a river had a constant slope of bed for its whole course, the velocity of flow would increase as its volume increased on its course to the sea; but it is observed in the upper reaches of the rivers, among the hills, Nature provides for dealing with excessive slopes, by water falls, barricades of rocks and rapids formed by boulders. On debouching from the hills, rivers are comparatively broad and shallow, with steep bed slopes, and become comparatively narrow and deep in the latter portion

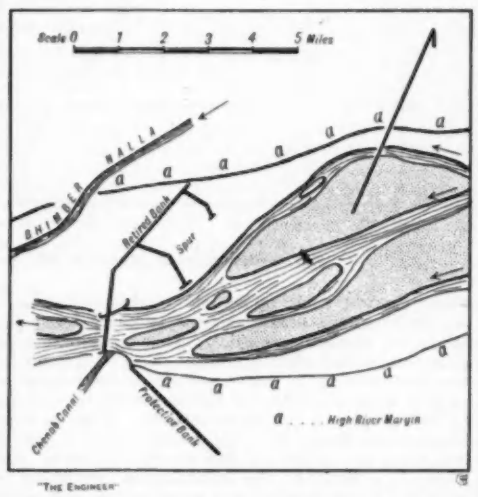


FIG. 1—DIAGRAM OF CHENAK RIVER AT KHANKI

of their passage to the sea, and, by assuming a tortuous course, reduce their slope. There is thus a reduction of acceleration and the mean velocity of flow becomes constant, or, to a greater extent, equalised by the diminution of the rate of fall.

Moreover, the flow of a river, particularly in flood, is not the same in the whole transverse section. It is greatest in what may be termed the "live stream," or deep channel of the river, called by continental engineers the "thalweg." Beyond the "live stream" there are zones in which the water is either stagnant, or even at times when it has a movement in the opposite direction to the usual current, especially in cases where the river suddenly widens out. In low water the flow is more or less confined to the deep channel.

In rivers flowing through alluvial soil, the windings are a natural phenomenon arising from the equilibrium between the erosive force and the tendency of the waters to deposit. The first aim of the water is to follow the line of slope of the country, but if the river causes erosion and scours its bed, it creates a counter slope where it deposits its burden of silt, and the current deviates from its regular course to get round the obstacle, and in this way bends are formed. In a winding bed, the strong current and, consequently, the deep channel, is carried over to the concave bank by centrifugal force, there it becomes concentrated and hollows out its bed; whereas, in the intermediate reaches, it spreads, its velocity is reduced and silt is deposited. The centres of the pools or deeps do not coincide with the apexes of the concave bends, but, as a result of inertia, are moved lower down stream. In the same way, the greatest deposit is found down stream of the point of transition from convex to concave bends. The deviation and curvature are controlled by the volume of water flowing down the river. The greater the volume and consequent velocity of flow, the greater its power to transport silt, and the greater its resistance to change of direction and the less sinuous is the course of the channel.

When a river flows over beds of sand or gravel, there are observed, in the low-water channel, alternate zones of still water, in which the speed is hardly perceptible, and in which there is a great comparative depth of water; or there are rapids or shallows, generally placed at the bends of rivers where the inclination of the bed and speed of the current are considerable, and where there is a small depth of water. These shallows form natural barriers which raise the plane of the water in the direction of the "up stream," and which are generally oblique to the direction of the channel. At high water, when the river is in flood, these natural barriers are not discernible, the obstructive effect of irregularities in the bed diminishing as the depth of water increases.

In the large rivers of India, in the plains, the main, or low, water channel is a comparatively narrow channel meandering in a vast bed of deep sand, which bed, often several miles in width, is confined between high marginal banks of alluvial soil. The low-water, or main, channel is free to wander within the limits of the alluvial margins, often, however, spreading out into larger sheets of shallow water where the channel crosses from one side of the river valley to the other. The high marginal banks of alluvial soil may be 3 miles apart, and the low-water, or main, channel may only have a width of 600ft. to 800ft. and a depth of from 15ft. to 20ft. This channel oscillates in the sandy bed as regularly as the waves produced by shaking a rope held at one end, the rope at the same time moving forward. The river Indus is stated to take 20 years to perform the whole process from the time it commences to cut the marginal bank at a particular place, leave that point and again attack it. This regular oscillation has also been observed in other Indian rivers. The sinuosity varies with the grade of the sand bed, and with the volume of flood water passing down; the smaller the volume of flood the greater the sinuosity. There are exceptions to the oscillation, as where there is a specially sharp bend in the river. There are also nodes from which the channel does not depart appreciably in its vagaries. There is a tendency for the low-water channel, once it attains to a rocky flank, to adhere to that flank. Sir Bradford Leslie has also pointed out that the configuration of the rivers in Lower Bengal depends on the existence of the hard clay formation at varying depths. This clay yields very slowly to the erosive action of the current, and where it rises above low-water level it fixes the topographical features of the river ("Proceedings," Institution of Civil Engineers, Vol. CLX. page 180). Sir Robert Gales, in his paper on the "Harding Bridge over the Lower Ganges at Sara," states that the only material in the delta capable of offering serious resistance to erosion by water appears to be the Sara clay, a black sedimentary deposit containing small shells and traces of rice peat. Clay also occurs at Raita, and the existence of the Raita and Sara clays has been the cause of the comparative stability of the river in the vicinity of Sara (*vide* "Proceedings," Institution of Civil Engineers, Vol. CCV., page 22, and Plate I., Figs. 3 and 7).

During floods the river deepens and widens the low-water channel, which then becomes the "live channel" of the river, the width and depth of scour in the sand bed depending on the volume of water flowing down, the velocity of the current, and on the grade of sand forming the river bed. All Indian rivers have a natural depth of scour and a natural width of live channel; no designable width of channel will induce the flood water to flow in it with diminished depth. If the velocity attained is unable to produce further scour in depth, the width of the live channel is increased. When the limits of erosion of bed and and sides are reached the channel spills over the shoals and the river eventually becomes a vast body of water extending from one high margin to the other, parts moving at a less velocity than the main, or "live channel," and parts stagnant, as already described. The spills which flow over the shoal collect into creeks, which become subsidiary channels and eventually fall back into the main stream.

Harlacher's experiments show the motion of streams to be unsteady; the water surface is in a state of constant slight rapid oscillation. There is some ground for expecting that the surface of a stream should be convex, that is, standing highest where the velocity is greatest. Generally, the surface is convex as a river is rising, level when the river is stationary, and concave when the river is falling, so that, in a rising river, drift material is thrown shorewards, and in a falling river it travels down the centre of the stream. When large Indian rivers are in flood, and the flood waters extend for several miles across, from one marginal high bank to the other, the "live channel" foaming and boiling up above the level of the waters is easily observed. Fig. 1 is a diagram of the Chenah River, North India, at the site of the head of the Chenah canal at Khanki. The weir is constructed at the left bank of the river, at a point where the full bed of the river may be nearly 3½ miles broad. The weir itself is only 4500ft. long and the flood water is forced to pass over this weir by training banks. The weir is protected by "Bell bunds" up and down stream. Soon after the works were constructed the river made a set to the north and threatened to outflank the "retired bank." To prevent such an occurrence and to direct the course of the stream towards the weir, spur groins were

constructed. Mr. R. E. Purves, in describing the great flood in the river at Khanki on July 24th, 1903, states that during the flood the main current followed the cold weather course, passing down at a point 2 to 2½ miles above the weir from right to left diagonally at the canal regulator, and then back to the right at a point 2 or 2½ miles below the weir. Thus, the stream, while flowing over the entire width of the channel, nevertheless had a strong current in the form of an arc with a chord 4 or 5 miles long.

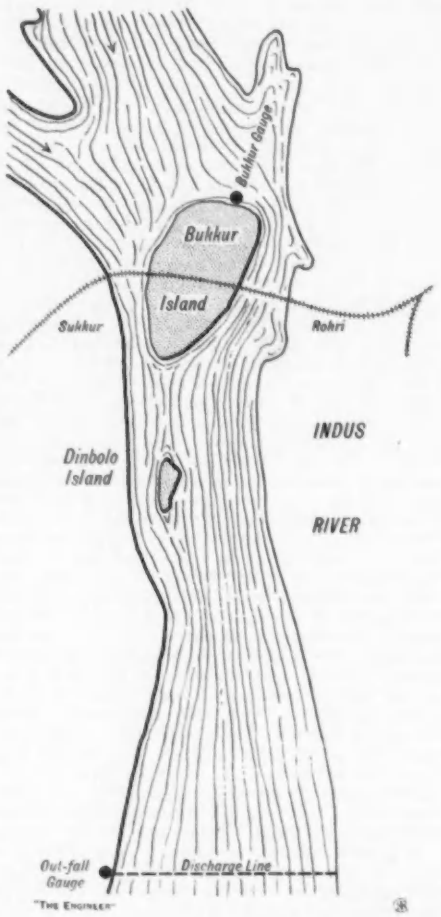


FIG. 2—"OUT FALL GAUGE" BELOW BUKKUR GORGE

There was a cross slope of 2ft. from the left to the right flank of the river ("Proceedings," Institution of Civil Engineers, Vol. 223, page 300).

Mr. Edgar Thrupp states that in the flood of July, 1926, in the Fraser River, the level of the water in the centre was obviously several inches higher than at the sides. This motion of the water near the side was in irregular cycloidal eddies, sometimes actually turning a little upstream, although on a slightly concave bank. The water near the bank was carrying a larger quantity of air in very minute bubbles, which were audibly fizzing out at the surface. Evidently, therefore, the air must be entrapped in the rippling and choppy places in the middle of the stream and conveyed to the sides by the lateral cycloidal eddies ("Proceedings," Institution of Civil Engineers, Vol. 223, page 304).

In the flood of August 15th, 1864, in the Towah River, a feeder of the Nerbudda River, India, the water level at the railway bridge across it, at the left abutment, was 90; at the right abutment, 97·25, and at piers 7 and 8 in the centre of the stream, the level was 101. The river Towah rises in the Satparah Hills and falls to the bridge 1550ft. in 50 miles, below the bridge the fall is 4·25ft. per mile. The bridge consists of eleven spans of 74ft. each. The velocity of the flood was estimated at 16·58ft. per second ("Proceedings," Institution of Civil Engineers, Vol. XXVII., page 223).

Marginal Erosion.—The curvature of the bank and angle of attack have an important influence on the extent and depth of erosion of the marginal alluvial banks of a river. The erosive action is due to eddies produced where flowing water runs past water at rest or flowing in a contrary direction, so as to cause a swirling action which may cause erosion to any depth. The cutting is worst and keeps on longer where the water is deep against a bank, and there is a supplementary strong current to carry away the fallen, or scoured, material. This combination is, as a rule, found on the concave side of a bend, so that the cutting is worst and keeps on longest in such a situation; hence, the tendency for a bend to cut deeper on its concave side. When a bend becomes so sharp that the radius of that side is less than the width of the stream it opens out. There is a limit to the incutting or curvature of erosion. Every section of a river has, as well as its natural limiting radius of curvature, its natural depth of scour, the depth to which it would, and did, scour at any bend. Mr. A. Morse has observed that experience has shown that Indian rivers, as a rule, do not cut a loop in such a way as to make the versed sine of the arc greater than half the chord of the loop. There obviously must be some point at which the slope of such a channel would become so small compared with the slope of the main river bed that the river would take the shorter course to its normal bed ("Proceedings," Institution of Civil Engineers, Vol. CLIV., page 9; *vide* also Plate II., Figs. 5, 6 and 7).

Deposit and Scour.—River beds are formed of material heavier than water, such as sand, gravel, &c., transported in suspension, or rolled along the river bed. This property of a current of water of transporting material of greater density than itself leads to the conclusion that pressures in flowing water are not proportional to the depth. Bodies plunged into a current of water to different depths are subject to differential pressure, the form of suspension depending on these pressures. The form of suspension is proportional to the velocity of the given point and to the relative velocity in the vertical sense. There are three layers found in any open channel. In the lowest the solid matter is rolled along the bed, in the middle the light solid matter is in suspension, and in the upper layer the true current carries the light alluvial matter. The scouring capacity of a channel depends, therefore, on the rate of change of velocity along a vertical as well as on the absolute velocity. In an open channel there is also a variation in transverse velocity and horizontal eddies have silt-suspending powers as well. A stream in good regions must, therefore, have a certain ratio of depth to width, varying with the volume of water passing down and the grade of material transported. The power of water to transport material would, therefore, depend directly as the velocity and inversely as the hydraulic mean radius, or, approximately, the depth. If the velocity be increased and the depth remain constant, there will be a tendency to scour, and, *vice versâ*, if the velocity decrease and the depth remains constant, there will be a tendency to deposit. These conditions apply whatever be the material a river bed is composed of. In the upper reaches of large rivers, boulders are often rolled along the bed, while smaller ones and stones are carried along in suspension. M. Palle Bruun states: "When examining the action of a small quantity of the water ascending the suction pipe of a sand dredger, it will appear that there are internal movements in the water which absorb energy. In order to preserve equilibrium energy must be supplied to it in a quantity sufficient to raise the water and make up for the internal losses. If, now, a particle of water be replaced by a particle of sand, in which no loss of

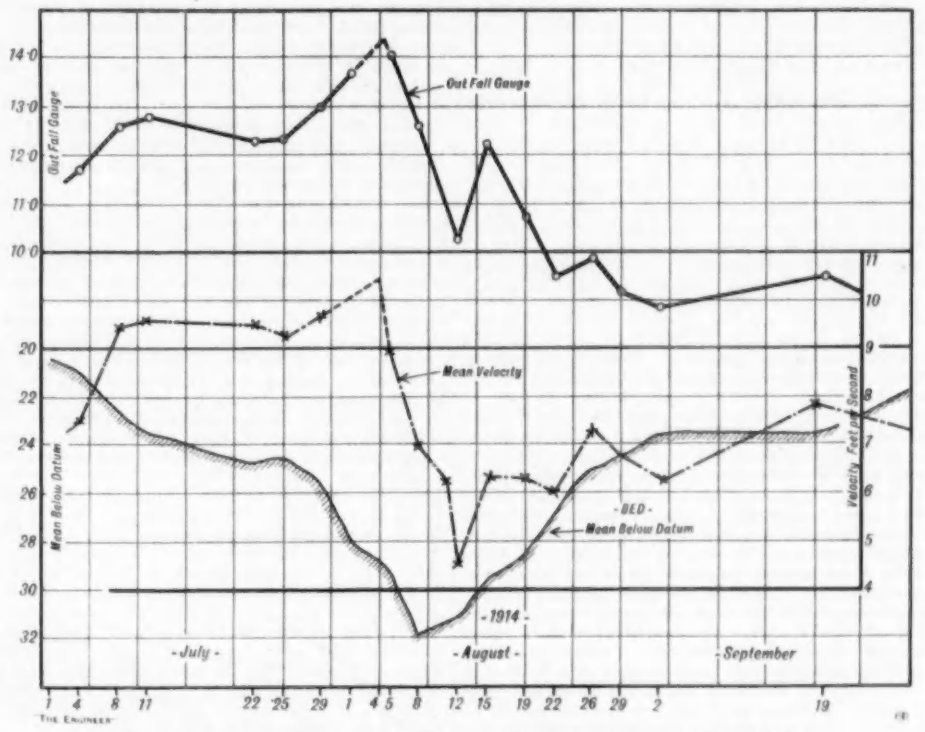
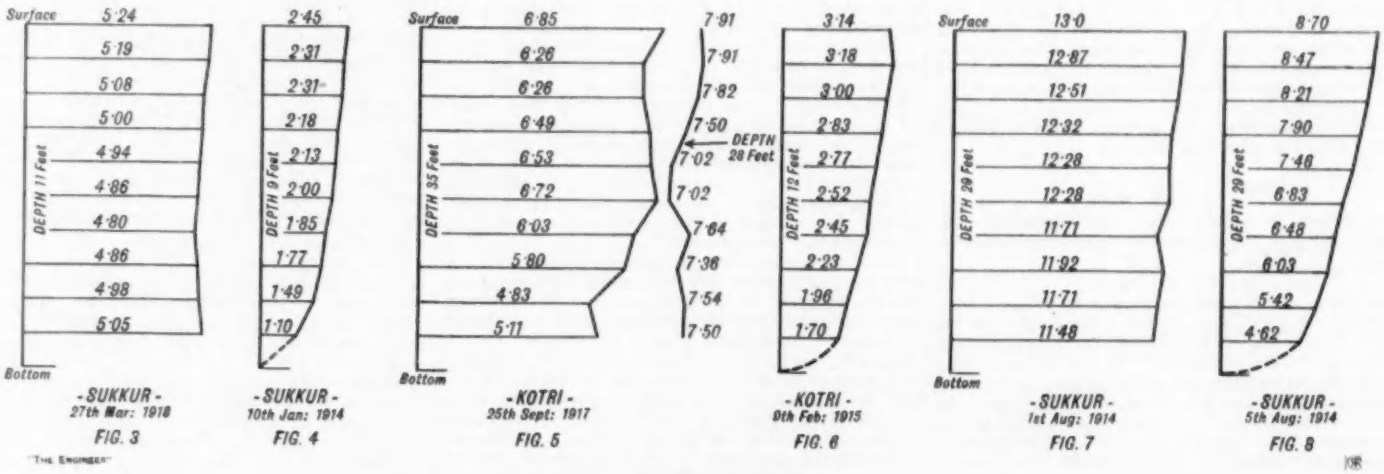


FIG. 9—HYDRAULIC DETAILS OF RIVER INDUS FOR FLOOD SEASON 1914



VERTICAL VELOCITY CURVES

energy takes place, it will be necessary, in order to preserve equilibrium, that the particle should be somewhat heavier than water, otherwise the same amount of energy could not be expended in the same volume. If the particle were of the same weight as water the saving of energy would result in an accelerated movement. The greater the speed of the water and the greater its disturbance and consequent consumption of energy, the larger may be the particles held in suspension. As regards suspended matter, the weight being proportional to the cube, and the resistance to movement with the square of the linear dimensions, objects of the same specific gravity sink more quickly the larger they are ("Proceedings," Institution of Civil Engineers, Vol. CLXXIX., page 414). W. T. Login has stated that in clear water a velocity sufficient to carry along large stones, when once it has obtained its load of silt, will leave the sand or clay bed of a river undisturbed. Also, three times the velocity was required to hold in suspension earthy matter admitted into a canal from a turbid river, that would be sufficient to disturb and roll along the same description of matter over the bottom if the water was clear. He gives as example the case of a hill torrent highly charged with silt rushing through a bridge with a velocity of 7½ft. per second and causing no apparent scour of bed ("Proceedings," Institution of Civil Engineers, Vol. XXVII.). Carried to its logical conclusion in a stream fully charged with silt, the spiral eddies are damped or completely obliterated and the flow tends to become stream line. The report of the Indus River Commission, 1902–1920, throws further light on the subject. Silt observations are made twice a week at Sukkur and once a week at Kotri. At Sukkur the Indus rushes through a gorge of limestone rock forming a rapid when the river is in flood. The width of the pass between Sukkur and Bukkur island is 350ft. to 400ft., and between Bukkur and Rohi 600ft. The discharges and other observations at Sukkur are made at the "Out Fall Gauge," 2 miles below the Bukkur gorge, and are outside the eddies formed at the gorge—Fig. 2. Kotri, some 300 miles lower down the river, is at the head of the delta. The bed and banks at Kotri are of clay and have remained permanent for many years. The surface fall of the river in flood from Sukkur to Kotri is about 0·45ft. per mile. The silt measured is that carried in suspension only. The report states that observations on vertical lines show a steady increase in the silt in the water, as the depth increases. The amount of silt increases with the stage of the river, the maximum usually occurring a little before, or after the river reaches its highest stage. The maximum quantity of silt in the river generally occurs when the river is rising and the minimum when it is falling. The maximum quantity of silt recorded during the period under observation was at Sukkur, on March 27th, 1918, viz., 3200 grains per cubic foot, with a rising river, and at Kotri, on September 25th, 1917, viz., 2946 grains per cubic foot, with a falling river. The minimum quantity of silt recorded was, at Sukkur on January 7th, 1914, viz., 49·9 grains per cubic foot, falling river, and at Kotri, on February 9th, 1915, viz., 100 grains per cubic foot, falling river. Diagram Fig. 3 shows the vertical velocity curve at Sukkur on March 27th, 1918, and Fig. 4 shows the vertical velocity curve at Sukkur on January 10th, 1914. No observation appears to have been taken of vertical velocities on January 7th, 1914. The variations in the two curves are characteristic of the conditions obtaining. In the fully laden stream the curve approximates to a straight line indicating stream line flow, whereas in the clear stream the curve approaches a parabola, indicating turbulent flow. Fig. 5 shows the vertical velocities at Kotri on September 25th, 1917, for depths of 28ft. and 32ft., and Fig. 6 shows the vertical velocity at Kotri on February 9th, 1915. Similar conditions obtain here also.

Table I. gives hydraulic details at Sukkur for the month of March, 1918. The datum line at Sukkur is 14·5ft. on the Out Fall Gauge. The column "Mean below datum" is the mean depth of the river below datum and indicates the extent of scour and deposit at the Out Fall Gauge site. The datum area is the actual area between the datum line and the river bed, and serves to show the changes which take place in the river bed. The column "Silt" is taken from the silt diagrams which accompany the report; the numerator indicates the average quantity and the denominator the maximum quantity of silt carried in suspension in grains per cubic foot. The indices in the column "Out Fall Gauge," *o o*, *r* and *f* indicate whether the river was stationary, rising, or falling since the previous day's stage. A study of Table I. shows that the amount of silt held in suspension has a marked influence on the velocity of the river. On March 27th, the velocity and discharge was greater than that of March 30th (falling river) although the stage of the river was higher and the area of water section greater. Also on April 6th, the deposit or fill was less than that of April 10th, although the stage and velocity of the river on April 10th was considerably greater than that of the 6th, and a greater scour would have been expected, while, on the contrary, the column "Mean below datum" shows a rise of mean bed of nearly a foot.

Table II. gives the hydraulic details for the flood season of 1914 at Sukkur. The maximum amount of silt carried in suspension that year at Sukkur was on July 28th, the amount being 2300 grains per cubic foot. The maximum flood level was reached on August 4th, 17·4 being registered on the Bukkur gauge. On August 5th, the river began to fall. The velocity and discharge that day were less than that of August 1st, when the river was rising, although the stage of the river on the 5th was higher than that of the 1st. Fig. 7 shows the vertical velocity curve on August 1st, and Fig. 8 shows the vertical velocity curve on August 5th. The maximum scour occurred on August 8th, when the river was falling—a fact frequently observed that the most severe scour takes place as the flood falls. Diagram Fig. 9 shows the hydraulic details of the Indus River for the Flood Season, 1914. The Out Fall Gauge readings are noted as not likely to be influenced by the oscillation of the river at the Bukkur Gorge. The mean velocity and mean below datum are taken from Table II. The mean below datum indicates the extent of scour and fill at the gauge site.

TABLE I.

March, 1918.	Bukkur Gauge.	Out Fall Gauge.	Area of water section.	Area below datum.	Mean depth.	Mean below datum.	Maximum depth.	Fill—Scour+	Mean velocity, ft./sec.	Discharge, cusecs.	Silt in suspension.
2	−0·1	−0·9oo	10,358	62,989	3·13	18·56	18	−2,981	2·90	29,025	220/350
6	−0·3	−1·1oo	9,993	63,298	3·02	18·62	15	−2,663	2·87	28,660	300/350
9	−0·3	−1·1oo	11,090	64,425	3·35	18·95	12	−1,636	2·53	28,083	220/350
13	−0·2	−1·0r	11,489	64,476	3·47	18·97	13	−1,485	2·48	28,536	300/470
16	−0·1	−0·7oo	13,011	64,987	3·92	19·12	13	−974	2·27	29,595	250/300
20	0·0	−0·8f	13,285	65,595	4·01	19·31	12	−366	2·27	30,138	300/470
23	3	1·3r	22,629	67,964	6·76	19·96	12	+2,063	3·47	78,508	1,650/2,606
27	5·2	3·6r	24,634	62,211	7·30	18·20	19	−3,750	6·23	153,400	2,670/3,200
30	5·6	4·4f	33,196	58,051	6·81	16·91	15	−7,910	5·84	135,531	1,706/2,000
April, 1918.											
3	3·6	2·7f	19,690	60,253	5·87	17·67	10	−5,708	4·31	84,884	900/1,106
6	3·4	2·4oo	19,021	60,627	5·67	17·77	11	−5,334	4·40	83,611	800/950
10	9·8	7·4r	33,067	57,605	9·75	16·85	14	−8,356	8·50	280,937	2,406/2,800

TABLE II.

Month and date.	Bukkur Gauge.	Out Fall Gauge.	Area water section.	Area below datum.	Mean depth.	Mean below datum.	Maximum depth.	Fill—Scour+	Mean velocity.	Discharge.
July, 1914.										
1	12·6	11·2r	58,389	69,825	17·3	20·43	23	+3,864	7·14	417,153
4	13·5	11·7r	61,797	71,502	18·12	20·92	23	+5,541	7·44	459,823
8	15·1	12·6r	70,963	77,555	20·80	22·70	25	+11,590	9·46	671,876
11	15·4	12·8r	74,681	80,582	21·83	23·58	28	+14,621	9·58	715,346
14	13·1	—	—	—	—	—	—	—	—	—
22	14·5	12·3r	77,207	84,831	22·65	24·55	32	+18,870	9·51	734,439
25	14·6	12·3oo	76,938	84,448	22·58	24·78	32	+18,487	9·24	710,931
29	15·8	13r	82,957	88,160	24·29	25·79	34	+22,199	9·68	802,758
August, 1914.										
1	17	13·7r	93,234	96,014	27·19	27·99	37	+30,053	10·18	948,928
4	17·4	Maximum	flood level	of 1914.						
5	17·3	14·1f	98,769	100,160	28·76	29·16	38	+34,199	8·96	885,165
8	15·3	12·6f	102,400	108,994	30·9	31·99	46	+43,030	6·94	710,686
12	11	10·2f	91,410	106,086	26·85	31·15	46	+40,125	4·43	405,352
15	14·4	12·3r	93,386	100,965	27·34	29·54	46	+35,004	6·35	593,186
19	12·3	10·7f	84,697	97,849	24·90	28·70	46	+31,888	6·31	534,660
22	10·8	9·5f	73,795	91,090	21·72	26·72	33	+25,129	6·19	457,266
26	11·2	9·9r	68,988	84,886	20·29	24·89	30	+18,925	7·29	502,799

The avidity of a stream for silt, therefore, depends, among other factors, on the variation of its velocity in a vertical sense. When the stream is carrying its full load of silt, the variations of velocities in a vertical become less marked and the curve approaches a straight line, and then its avidity for silt and, consequently, its power of scour, is considerably reduced.

(To be continued.)

The Gold Mining Industry in Canada.

In view of the probability that Canada may shortly take the second place among the world's gold producers, the following particulars based on a Bulletin recently issued by the Dominion Bureau of Statistics at Ottawa may be of interest, although the statistics quoted are the final returns for the calendar year 1928, and do not cover the production of last year, which reached 39,840,722 dollars in value, the 1928 total having been 39,082,005 dollars.

Gold mining in Canada falls naturally into two main divisions: (1) The taking of gold from the gravels of the rivers and streams, or what is known as "alluvial gold mining," and (2) the recovery of lode gold, which is called auriferous quartz mining. But gold is often associated with other metals, more particularly with copper, and for that reason the review of Canada's copper-gold-silver mining industry is included here to complete this review of Canada's gold mining industry.

Production of gold during 1928, from all sources in Canada, amounted to 1,890,592 fine ounces, valued at 39,082,005 dollars, as against an output of 1,852,785 fine ounces valued at 38,300,464 dollars in 1927. This was the largest output recorded before 1929, when there was a new record output of 1,927,295 ounces, valued, as stated above, at 39,840,722 dollars.

The output in 1928 was recovered from the following sources:—Fine gold contained in crude bullion made by gold mines, 1,607,337 fine ounces; alluvial gold, 40,855 fine ounces; fine gold in blister copper and base bullion made at Canadian smelters from Canadian ores, 90,929 fine ounces; the estimated recovery of gold in ores and concentrates exported to foreign smelters, 148,207 fine ounces, and 3264 fine ounces from miscellaneous sources.

Six provinces and the Yukon Territory produced gold as follows:—Nova Scotia, 1290 fine ounces; Quebec, 60,006 fine ounces; Ontario, 1,578,434 fine ounces; Manitoba, 19,813 fine ounces; Alberta, 68 fine ounces; British Columbia, 196,617 fine ounces; Yukon, 34,364 fine ounces. Gold from Nova Scotia was produced in the form of crude bullion and was shipped to the Royal Mint at Ottawa for refining. The greater part of the Quebec output was contained in the blister copper made at the Noranda smelter. The remainder was made up from the gold contained in concentrates shipped from the Teteault silver-lead-zinc property and from high-grade ore taken from a property in the process of development.

In Ontario the Porcupine area contributed 979,416 fine ounces; Kirkland Lake produced 591,797 fine ounces; Sudbury district copper-nickel ores yielded 3850 fine ounces and 3371 fine ounces were recovered from miscellaneous sources. Manitoba's production consisted of 19,813 fine ounces, which was contained in crude bullion made. Receipts at the Royal Mint from Alberta amounted to 68 fine ounces.

The output from British Columbia consisted of 6739 fine ounces, derived from alluvial deposits, 16,157 fine ounces from lode gold mines, and produced in the form of crude bullion; gold in blister copper, 31,057 fine ounces, and gold in base bullion and in ores, 142,664 fine ounces.

In the Yukon Territory, 34,116 fine ounces were recovered from alluvial deposits and the remainder, 248 ounces, was contained in ores exported.

Gold held second place in point of value among Canada's mineral products in 1928, being surpassed only by coal; the value of gold represented 14·2 per cent. of the total mineral production of the Dominion. As a world producer of gold Canada ranked third. South Africa was first with a production in 1928 of 11,300,979 fine ounces, and United States second, with an output of 2,194,295 fine ounces.

The Alluvial Gold Mining Industry.

Alluvial gold mining in Canada is carried on in the Yukon Territory and in the Province of British Columbia. In the Yukon only three companies were actively engaged, though many individual placer mines were working on their claims during the year. Two companies used gold dredgers and one operated by hydraulic mining.

The principal placer camps in British Columbia are in the Atlin and Cariboo districts, though some gold is recovered from the Tulameen and Similkameen rivers in the southern part of the province. The Kafue Copper Development Company's dredger was closed down shortly after commencing operations in Cunningham Pass Creek, as the gold values were found to be practically all on or in lime bed rock and were, consequently, not recoverable by dredging. Large operators in the Atlin, Quesnel and Similkameen mining divisions confined their attention to development work. In 1928 there were 82 companies or individual operators engaged in winning alluvial gold, either in the Yukon Territory or in British Columbia. Crude gold recovered amounted to 51,069 oz., valued at 849, 916 dollars.

Auriferous Quartz Mining.

In 1928 Canadian auriferous quartz mines numbered 100 in all, producing 4,601,628 tons of ore, of which 4,483,053 tons were milled. Tailings re-treated amounted to 43,536 tons; gold bullion recovered by amalgamation at six mines amounted to 145,095 crude ounces, and by cyanidation 1,905,860 crude ounces. Consignments of bullion having a total value of 33,367,353 dollars amounted to 2,049,648 crude ounces, containing 1,607,337 fine ounces of gold and 245,241 fine ounces of silver. Ores, concentrates and high-grade slags delivered to smelters totalled 132,949 tons, having a net value (less freight and treatment charges) of 3,287,977 dollars. These consign-

ments contained 134,983 fine ounces of gold, 2,502,722 fine ounces of silver, 72,776 lb. of copper and 1,318,000 lb. of arsenic.

Of the operating mines in 1928, 34 only produced bullion or despatched ore, while 66 carried on development work only. In Nova Scotia 3 mines produced gold; in Quebec some gold was recovered from some high grade ore raised during development work. In Ontario the principal producers were the Hollinger, Dome, McIntyre and Vipond in the Porcupine area, and the Lake Shore, Teck-Hughes, Wright-Hargreaves, Sylvanite and Kirkland Lake in the Kirkland Lake camp. Intensive development work was done during the year at the Howey mine in Red Lake. During the latter part of 1928 a new field was discovered in Crow River section. The Patricia district was prospected by diamond drilling and showed very promising assays in gold. Only one mine, the Central Manitoba, produced gold in the province of Manitoba during 1928. Development work was carried on at several properties in the same district.

In British Columbia the principal gold mines were the Pioneer, Nickel Plate and Premier. At the Premier, the value of the gold is about one-half the total for the mine, the remainder being silver. There is also some lead in the Premier ores. Ores from the Nickel Plate mine are cyanided and concentrated. Crude gold bullion is produced and the concentrates, containing arsenic and gold, are shipped to the Tacoma smelter. Gold is recovered from the ores of the Pioneer mine by cyanidation. Several gold properties in the development stage shipped gold ore to the Trail smelter.

The total capitalisation of this section of the industry in 1928 was 147,693,710 dollars, a considerable increase as compared with the 118,381,468 dollars representing the total capital investment in 1927. The number of persons employed was 9066, the underground workers numbering 5153.

Copper-gold-silver Mining.

A considerable quantity of gold is produced in Canada, particularly in British Columbia, from a group of mines producing ores containing copper, gold and silver, in which copper values predominate. In addition, Manitoba's known ore reserves are being developed. One copper-gold-silver mine in Ontario has despatched ore to the Noranda smelter in Quebec, and experimental consignments of copper concentrates, lead concentrates and zinc concentrates have been made from a mine in the Sudbury district of Ontario. In Quebec the Consolidated Copper and Sulphur Company, Ltd., operating the Eustis mine, produced copper concentrates and pyrites concentrates for export and the Noranda smelter of the Horne Copper Corporation operated continuously throughout the year producing blister copper, mainly from the Horne mine, though some custom ore was smelted. The average analysis of the blister copper made was 99·27 per cent. copper, 11·20 oz. silver, and 3·18 oz. in gold. The gold contained in the copper ore smelted added considerably to the gold production of Quebec in 1928.

The principal properties operating in British Columbia in 1928 were the Hidden Creek mine at Anyox, which shipped to the Granby Consolidated Mining, Smelting and Power Company, Ltd., the Britannia mine on Howe Sound, a short distance up the coast from Vancouver, which shipped concentrates to the smelter at Tacoma, Washington, U.S.A., and the mine at Copper Mountain, near Princeton, owned by the Granby Consolidated, from which ore was shipped to the concentrator at Allenby, the concentrates being sent during the first part of the year to Trail and during the latter part of the year to Tacoma.

During the year 4,262,822 tons of ore were raised, 3,773,156 tons were milled and 227,382 tons of copper concentrates and 63,983 tons of pyrites concentrates, were produced. Shipments to Canadian smelters consisted of 480,768 tons of copper ore and 104,181 tons of copper concentrates; to United States smelters, 3127 tons of ore, 125,457 tons of concentrates and 65,479 tons of iron pyrites. These shipments, comprising 779,012 tons, had a value of 15,281,519 dollars, and contained 84,811 fine ounces of gold, 809,542 oz. of silver, 136,931,615 lb. of copper, 33,615 tons of sulphur, and small amounts of cobalt, arsenic and zinc.

INSTITUTION OF ELECTRICAL ENGINEERS.

SCHOLARSHIPS IN ELECTRICAL ENGINEERING.

The Council of the Institution of Electrical Engineers has established the following Scholarships, the first awards of which will be made this year:—

Duddell Scholarship.—This Scholarship is of the annual value of £150 and is tenable for three years. Each candidate must be nominated—not later than June 15th, 1930—by a Corporate Member of the Institution, and preference will be given to candidates whose fathers or a near relative are or have been members of the Institution. The award is open to British subjects under nineteen years of age on July 1st, 1930, who have passed the Matriculation Examination of a British University or an examination exempting from Matriculation, and who wish to take up a whole-time day course in electrical engineering.

Ferranti Scholarship.—This Scholarship is of the annual value of £250, and is tenable for two years. Each candidate must be nominated—not later than August 15th, 1930—by the professor or teacher under whom he is working or has worked, and preference will be given to candidates whose fathers are or have been members of the Institution. The award is open to Britsh subjects under twenty-six years of age on July 1st, 1930, who are Students or Graduates of the Institution and have been such for not less than two years, and have completed to the satisfaction of the Council a recognised electrical engineering course of at least three years and who desire to carry out whole-time research or post-graduate work.

Applications—specifically mentioning the name of the Scholarship—for particulars of and Nomination Forms for these Scholarships should be addressed to the Secretary of the Institution, Savoy-place, London, W.C. 2.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

RADIANT HEAT IN BOILER FURNACES.

Sir,—The reputations of Reynolds, Perry, Nicolson, or Callendar need no defence, but your leader-writer is not so securely placed as yet. In your issue of the 16th inst., pp. 549–550, you appear to blame the authorities named for the indifference of designers of steam generators to the fundamental laws of heat-transmission. Does not the explanation lie in the omission of the technical Press to ventilate these questions at the time the deductions were made?

In 1874, Osborne Reynolds published his explanation of the observed fact that locomotive boilers were "as economical when working with a high blast as with a low." About 20 years later Perry's attention was drawn to this deduction by a lecture by Stanton, and then Dr. Nicolson took up the tale where Perry left it. In spite of all this ventilation, the apathy of their contemporaries persisted. We have heard the advantages of high-speed gas-flow spoken of as a fetish, and a very full report, read ten years after Stanton's lecture, or thirty years after Osborne Reynolds, did nothing to emphasise the influence of high gas velocities. The investigators named should be praised for the fact that convection is now being considered by designers rather than blamed for designers' indifference to the laws of radiation!

Let the blame be put upon the want of receptivity of designers, and upon the slowness of the editors of the technical Press, and not upon those pioneers who told us fifty years ago where to look for improvements in heat transmission.

The very problem of the locomotive fire-box that you refer to and the Hudson-Orrok formula you praise were both dealt with by Dr. Nicolson twenty years ago!!

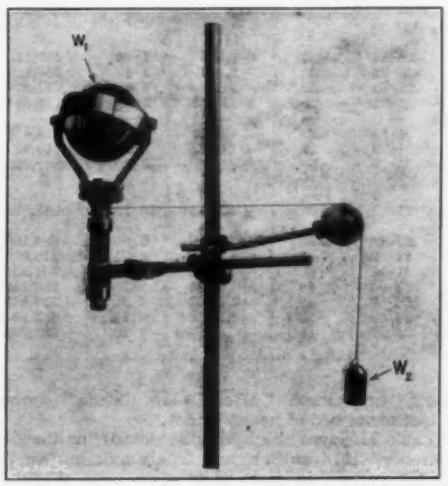
That the information has always been available is shown by the success of the radiation boiler described in Watson Smyth's recent I. Mech. E. paper, to say nothing of the results of our own waste heat boilers, that, thanks to Dr. Nicolson, have effected considerable economies in fuel consumption in several progressive steel works in this country.

Hyde, May 19th. Joseph Adamson and Co.

[We may remind Messrs. Adamson that at the time of Nicolson's paper (Junior Institution, 1909) there was great difference of opinion as to the value of his conclusions. Many letters upon the subject appeared in our columns, some by Nicolson himself. Our correspondents seem to have overlooked the fact that Hudson's views on the value of gas velocity appeared ten years before Nicolson's —*see* The Engineer, December 5th, 12th and 26th, 1890. —Ed. The E.]

AN INTERESTING GYROSCOPIC EXPERIMENT.

Sir,—A description of a gyroscopic experiment shown at the last Physical and Optical Societies' Exhibition, and recently at the Royal Institution, may be of interest to some readers. The accompanying illustration shows



the arrangement, in which a gyroscope is mounted as for three degrees of freedom, but with weights W_1 and W_2 applying moments round horizontal—H—and vertical —V—axes respectively. The motion round the vertical is made as frictionless as possible by ball bearings—using a cycle hub and spindle. The motion round the horizontal is limited to slightly under 360 deg. by stops, which prevent the spinning axis from becoming quite vertical.

The gyro wheel itself is one of the ball-bearing naval type and will spin for 15 min. or 20 min.

When started with weight W_2 at maximum height, *i.e.*, with the string fully wound on the drum, the gyro executes a series of precessional motions corresponding to the torques applied round the two axes by weights W_1 and W_2. The two weights descend and ascend repeatedly, alternately raising each other through the medium of the gyroscopic torque. No energy is extracted from the wheel, of course, except by friction.

Following the action in detail, it may be described as follows:—

Let the gyro be rotating counter-clockwise as viewed in the figure, *i.e.*, facing the weighted end. Let weight W_2 be wound to its highest point, and weight W_1 be placed at its lowest point, so that the axis of spin is nearly vertical. Let now the system be released.

(1) The vertical counter-clockwise torque due to W_2 starts a precession round the H axis, raising W_1 in the process. A simultaneous counter-clockwise rotation takes place round the V axis, lowering W_2 and gradually transferring the potential energy of W_2 to W_1.

(2) When the spinning axis becomes nearly vertical and the stop prevents further precession, the gyro torque round the V axis ceases. Weight W_2 then falls freely, spinning the frame and gyro, the kinetic energy of which re-winds W_2 to a less height, determined by friction.

(3) This spinning velocity of the frame, in decreasing, reaches a critical value at which weight W_1 commences to descend and so generate a counter-clockwise torque which continues to raise W_2.

(4) When W_1 reaches the lowest point as determined by the stop, with the spinning axis again nearly vertical, the gyro torque round the V axis again disappears. Weight W_2 again falls freely, spinning the frame and gyro clockwise and re-winding itself as before to a somewhat less height.

(5) W_2 again starts to fall, and the cycle of operations recommences as in (1) above.

It is interesting to note that the action of raising one weight by the other takes place whatever the relative values of the weights, if the friction is negligible. For instance, however small W_2 may be, it will raise W_1 at some finite rate. This can readily be seen if W_2 is looked upon as a force tending to "hurry" the already existing precession round the vertical due to W_1.

The whole action, during the falling of one weight, and the raising of the other, may be looked upon as a maintaining of the c.g. of the system at a constant height, since no energy, except that due to friction, is being expended.

Another instructive experiment closely illustrating this last point may be made. Weight W_2 and its string are removed and the V axis tilted so that it is held by the clamp at an angle of 15 deg. or 20 deg. to the true vertical. With the gyro spinning, the weight W_1 now, of course, causes a continuous precession round the V axis. Simultaneously, an oscillation round the H axis occurs and the weight W_1 appears to rise and fall with the rotation. Careful observation shows, however, that W_1 is actually keeping at a substantially constant level—if friction is small—*i.e.*, that the tendency is for the c.g. of the system to maintain constant height.

Rugby, May 19th. R. C. Clinker.

STEAM POWER AND WATER POWER IN CANADA.

Sir,—The statistics on water power in the pulp and paper industry of Canada in your issue of April 25th, 1930, are interesting, especially on account of the large powers involved. The remarks on steam power are, however, somewhat misleading—the use of steam power, you say, is very limited, amounting to 120,352 H.P., which, although only representing 8·2 per cent., is a very respectable figure.

You say that steam power is only used in connection with wood waste. This is an entirely wrong conception, as steam power is a by-product of the steam used for drying and heating no matter whether coal or wood refuse is burned under the boilers. As a matter of fact, a very small percentage of steam is raised from wood refuse.

I should point out that the use of by-product steam power in Canadian paper mills is now attracting very keen interest and many mills have adopted high-pressure steam plants in order to reduce power costs.

The latest mill, having an output of 500 tons a day, has installed one 6000 kW reducing turbo-generator and four 1000 H.P. paper machine turbines and one 1000 kW condensing turbo-generator. It is now proposed to install one 1500 kW back-pressure turbo-generator and two 10,000 kW condensing turbo-generators, the latter being as standby plant for the hydro-electric.

In the past three years the importance of this has been realised and the proposed steam pressure for new plants has been raised to 600 lb., thus enabling 28 per cent. of the power required in paper mills to be obtained from steam purely as by-product power.

The reason for this changing opinion is the low cost of by-product steam power—its reliability and the fact that it is not affected by climatic conditions.

Montreal, May 8th. A. D. Harrison.

Institution of Mechanical Engineers: North-Western Branch.—In order to show appreciation of the services rendered to the North-Western Branch of the Institution of Mechanical Engineers by Mr. Harry Richardson—who has just retired from the Hon. Secretaryship, which he had held for three years—the Committee of the Branch entertained him to luncheon at the Engineers' Club, Manchester, on Monday, May 12th. The chair was taken by Mr. H. L. Guy, the Chairman of the Branch, and the following members were also present:—Dr. Adamson, Capt. H. Beames, Messrs. C. Bentham, J. Bissett, Capt. N. W. Coe, Messrs. C. Day and Sterry B. Freeman, Professor A. H. Gibson, Messrs. C. H. Hunt, A. T. J. Kersey, A. E. Malpas, Dr. T. B. Morley, Mr. J. M. Newton, Professor G. E. Scholes, Professor Dempster Smith, and Mr. Ernest West. During the luncheon a presentation was made to Mr. Richardson from a number of past and present members of the Council, who had been associated with him during his term of office. The presentation took the form of a desk, the key of which was handed to Mr. Richardson by Mr. Guy.

Railway and Road Matters.

THE Canadian National Railway has put into effect a new train schedule which will greatly reduce the time on several routes. Fast trains now run between Montreal and Toronto, a distance of 334 miles, in six hours, and the time between Montreal and Chicago is 18 h. 15 min. The new time-table went into force on April 27th.

ACCORDING to the *Great Western Railway Magazine*, 51,313 season tickets were issued in 1923 from twelve stations within 40 miles from Paddington; to-day 132,151 are issued. It is as a consequence of this growth in the suburban traffic that Bishop's-road Station is, as related in this column on November 29th last, to be enlarged.

A REPLICA of the model of the Murray locomotive and the Blenkinsop rack rail in the Science Museum, London, has been sent to the Museum of Peaceful Arts, New York, by Mr. E. Kilburn Scott, chairman of the Matthew Murray Memorial Fund. Mr. Scott will also provide one for the Leeds Museum. Replicas of the Blenkinsop rack rail in the Leeds Museum have been supplied to four other museums.

A DIFFICULTY that faces the main line companies concerned in London traffic is that under the present scheme they cannot engage in the road transport business within the Metropolitan Police area, *i.e.*, 20 miles from Charing Cross. They consider it unfair, and the Minister of Transport has recognised this and has intimated to the companies that at an appropriate moment he will invite them to enter into a discussion with him on the subject.

IN this column of our issue of November 15th last, in referring to the electrification by the London, Midland and Scottish of the Wirral Railway, we did not say how much of the system was to be converted. We now learn officially that it extends from the junction with the Mersey Railway at Birkenhead Park to the terminus at West Kirby, together with the New Brighton branch. The Seacombe branch is not to be changed; with that exception, therefore, the whole system of 13¾ miles is to be converted.

IT was stated by Mr. Whitelaw, of the London and North-Eastern, recently that as steel sleepers cost 2s. 6d. each more than the present wooden sleepers, the company was not proposing to make any change in the present practice without further experience and consideration. In accord with the other railways the company was following up the matter by joint committees consisting of the technical officers of the companies, along with expert representatives of the National Federation of Iron and Steel Manufacturers.

THE Knott End Railway consisted of two sections; the first was from the Lancaster and Carlisle line at Garstang and Catterall to Pilling and from Pilling to the terminus at Knott End, on the river Wyre, opposite to Fleetwood. Under the Railways Act it was absorbed by the London, Midland and Scottish. As a consequence of the development of competitive road services the volume of passenger traffic has been reduced to such an extent that its continuance, not being economical, the railway ceased to be a passenger-carrying line on March 31st.

AN apparent anomaly in the figures as to road transport business in the London and North-Eastern Railway annual report has been explained away. In view of the company's new wide interests in road transport concerns, it came as a surprise to find that there was a loss of £17,000 on road transport, but it appears that that was in business done wholly by the railway. On the other hand, there had been a profit of £23,000 from railway and road joint services, but as that was not distributed until after the end of the year it did not appear in the accounts for 1929.

WE regret to announce the death on May 17th, with great suddenness, whilst in St. Paul's Cathedral at his younger son's confirmation, of Mr. R. H. Selbie, the general manager of the Metropolitan Railway. Mr. Selbie had been all his life in the chief traffic manager's office of the Lancashire and Yorkshire until in 1903 when he came to London to be secretary to the Metropolitan Railway. On the retirement of Mr. Ellis, the general manager, in 1908, Mr. Selbie succeeded him. Under powers specially obtained to allow the officers of the Metropolitan Railway also to be directors, Mr. Selbie was director and general manager. No other British railway had similar powers until the London, Midland and Scottish obtained them soon after Sir Josiah Stamp joined that railway.

THERE have been several letters in *The Times* recently as to the way in which Inner Circle trains on the Metropolitan Railway are held up at South Kensington. No explanation has been offered for that apparent annoyance, and it may interest our readers if we say that Inner Circle trains, on arrival at the point in question, are about to enter upon the Metropolitan District Railway. The Inner Circle trains, when on the Metropolitan, are very broadly timed and carry generally a comparatively light traffic. They thus arrive at South Kensington in advance of the booked time and so have to wait before they can enter on to the District Railway, where the timing is very fine. Another factor is that if the Circle trains arrive late they miss their turn and must wait for the next opening given in the District time table.

DURING the year 1929 the London, Midland and Scottish renewed 225 locomotives, of which 31 were built by contractors, heavily repaired 3573 and gave light repairs to 4065. At the end of the year 554 were under or awaiting repair, as compared with 605 at the end of 1928. The London and North-Eastern renewed 110, of which 36 were made by outside firms; 3005 locomotives were heavily repaired and 2301 received light repairs. At the end of the year 564 were under or awaiting repair, as compared with 624 at the close of the previous year. The Great Western renewed 182 locomotives, of which 62 were made by contractors. The number heavily repaired was 1238 and of lightly repaired 1658. There were 571 under or awaiting repair, as against 653 at the end of 1928. The number renewed on the Southern was 24, all constructed by the company; the heavily repaired numbered 929 and the lightly repaired 216. There were, at the end of the year, 153 under or awaiting repair, as compared with 242 at the end of 1928.

Notes and Memoranda.

IT is estimated that when the Pykara electric power development scheme of the Madras Government has been completed, electric energy will be produced at a cost of half an anna a unit.

A NOVEL feature in the latest skyscraper building projected in New York will be double-decked lifts, so arranged that passengers can be taken on and discharged at two floors simultaneously. The building is to be sixty-six storeys high.

THE tubes in the condensers of the East River power station of the New York Edison Company are cleaned by shooting a thin watery mixture of three parts of pulverised fuel ash and one part of sand, by means of air at a pressure of 100 lb. per square inch. According to *Power*, three men can clean 10,000 tubes in six hours.

A STUDENT at the University of Naples claims, according to the *Giornale d'Italia*, to have succeeded in constructing a machine by means of which he derives electrical energy from the air. Details of the apparatus are not available, but it is stated that it is quite simple and that by means of it he has produced sufficient current to light a lamp.

THE main characteristic which made Chinese wood oil so useful as a varnish and paint constituent was that it had very great drying properties. It not only dried rapidly, but it dried with a very hard and impervious film which was much less pervious to water than a similar film of linseed oil. There was also much less tendency for a dry film of wood oil to hydrolyse on contact with water or caustic, and it was much more resistant to caustic than linseed oil.

CAUSTIC soda and aluminium chips in the proportion of 25 per cent. soda and 75 per cent. aluminium by volume have been used in America as a means of thawing out frozen fire hydrants. In the presence of a small amount of water a chemical action takes place which liberates quite a quantity of heat. From 2 lb. to 4 lb. of the mixture is sufficient to thaw the ice in a frozen hydrant in less than five minutes. As used in Evanston, Illinois, the hydrant cap is unscrewed and the material is poured in on top of the ice. Flushing the hydrant immediately after it is thawed avoids the danger of chemical corrosion of the metal. The cost per hydrant has been between 60 cents and 1 dollar.

THE accepted theory of acid formation in coal mines with the subsequent appearance of the acid in coal mine drainage, is oxidation of iron pyrites and subsequent solution and hydrolysis of the iron sulphate formed. It has also been found that fire-gobbed sections and worked-out areas, where there is usually an abundance of iron pyrites-bearing materials in contact with air, are the sections that make the most important contribution to the quantity of acid drainage. It would thus seem obvious that if oxygen can be kept out of contact with the acid-forming materials in the sections mentioned, the amount of acid in coal mine drainage could be reduced markedly and corrosion problems with mine pumping equipment and general stream pollution mitigated thereby.

PROBLEMS associated with leakages of methyl chloride, one of the commonly used media for mechanical refrigeration, promise, according to the American Bureau of Mines, to be greatly simplified by the use of acrolein as a warning agent. This compound is the powerful eye, nose and throat irritant that is often formed when lard splashes on a hot stove. Acrolein is the chemical substance found to be the most suitable from the standpoint of warning properties and chemical stability when in contact with the metals and oil of refrigerating devices. The same bureau also states that the recent development of a refrigerant known chemically as dichloro-difluoro methane, promises to contribute greatly toward safety in automatic refrigeration. This compound is non-inflammable; in fact, it could be effectively used to extinguish fires. It is also practically non-toxic.

UNTIL recent years it was, says the *Chemical Trade Journal*, considered that the satisfactory welding of copper was an impossibility. The high thermal conductivity of the metal gave rise to grave practical difficulties, and even if these were overcome, it was found that the copper became brittle by the action of the gases in the acetylene flame. With the formation of Imperial Chemical Industries, Ltd., technical authorities who were interested in copper welding from three different points of view came together. They were chemical manufacturers, who required welded copper vessels; copper manufacturers, who were naturally anxious to see copper placed on the same footing as the majority of other metals, as far as welding is concerned; and experts in welding processes generally. As the result of research work carried out by these three groups in collaboration, a process for welding copper has now been evolved which renders the operation simple and safe, provided the correct materials are used.

THE efficiency of pulverised coal at sea was recently demonstrated in the voyage of the cargo steamer "West Alsek" from Ireland to Boston, during which the vessel encountered in the North Atlantic the most severe weather of recent years. The pulverising plant operated smoothly, even while the vessel was rolling 45 deg., and the results were highly satisfactory, in spite of the fact that wet coal of about 12,000 B.Th.U. was being used. The "West Alsek" is equipped with the "Todd" unit system of pulverised fuel burning, and has been in regular service for the past ten months, during which time the installation has performed satisfactorily on both American and British bituminous coal of the cheaper grades. The equipment has shown a 20 per cent. increase in horse-power and a 10 per cent. increase in speed, with an increase of only 3 per cent. in coal consumption. As a hand-fired installation the "West Alsek" burned 464 lb. of coal per mile with a speed of 8·78 knots and 1790 I.H.P. As a pulverised coal burner, however, only 449 lb. of coal per mile were used, with a speed of 9·58 knots and 2250 I.H.P. output. With the pulverising equipment it also has been possible to use a much cheaper grade of coal, besides which a 20 per cent. saving has been made in the boiler-room staff.

Miscellanea.

IT is intended to open the new Welland Ship Canal in Canada on July 1st.

A FACTORY for the manufacture of pneumatic tube conveying plant is to be put up at Joliette, Quebec.

IT is said that another deposit of copper ore, running about 8 per cent., has been discovered in Namaqualand, South Africa.

IMPORTS of calcium carbide into this country for the three months ended March 31st, 1930, were 12,776 tons. Of this total, 5137 tons came from Norway, 1430 tons from Sweden, and 1428 tons from France.

A NEW mill is to be erected at the Dorne gold mine, Ontario, in place of the mill which was burned down recently. The new mill is to be of the "all-cyaniding" type and will be capable of dealing with 1500 tons of ore daily.

THE Soviet Government has issued a licence for orders to be given to the English electrical industry. These orders, to the value of 3,000,000 roubles, are to be placed at the end of this month. The Soviet Government also intends to order three turbines for the Russian electrical works.

THE first of the 200,000 horse-power generators for the Beauharnois power plant, Quebec, has been ordered from the Canadian General Electric Company, of Peterborough, Ontario. The water wheels are being made by the Dominion Engineering Works. The ultimate capacity of the plant is to be 500,000 horse-power.

IT is announced that one of the Gloster-Napier seaplanes built for the Air Ministry for the Schneider Trophy contest has been acquired by a private individual. It is to be equipped with a supercharger, and it is hoped that a speed of about 400 miles an hour will be attained. If so, it will be entered for next year's Schneider race.

THE Harbour Commission of Vancouver will soon start work on a number of huge developments planned to improve Vancouver's shipping facilities. These will take the form of a new ocean pier, water-front cold storage plant, fish storage and fish wharf, and large additions to three terminal grain elevators, which will add 5,500,000 bushels to the port's grain storage facilities.

NOTICE is given in the *London Gazette* that the Home Secretary proposes to make Regulations, after forty days, as to the conveyance by road of vessels containing compressed air, argon, carbon monoxide, coal gas, hydrogen, methane, neon, nitrogen and oxygen. Draft copies of the Regulations may be obtained on application to the Under Secretary of State, Home Office, Whitehall, London, S.W. 1.

THE monthly returns of the National Federation of Iron and Steel Manufacturers show that the number of furnaces in blast at the end of April was 151, a net decrease of six since the beginning of the month. The production of pig iron in April amounted to 619,600 tons, compared with 665,800 tons in March and 611,300 tons in April, 1929. The production included 194,300 tons of hematite, 242,200 tons of basic, 134,700 tons of foundry and 26,800 tons of forge pig iron. The April output of steel ingots and castings amounted to 696,100 tons, compared with 826,100 tons in March and 808,600 tons in April, 1929. Although part of the decline is due to the Easter holidays, the figures reflect a definite downward tendency.

THE Secretary for Mines announces that, for reasons of administrative economy, and also with a view to securing closer collaboration between the staffs of the Mines Department Testing Station and the Safety in Mines Research Board, he has decided, in agreement with the Board, to transfer the Testing Station from the existing premises—at 42, Arundel-street, Sheffield—to a portion of the buildings occupied by the Board in Sheffield. The removal of the testing apparatus and plant will probably cause some slight delay in the official testing of safety lamps, electric bells and relays, telephones, &c., but every effort will be made to reduce such delay as much as possible. The address of the new Testing Station will be: Mines Department Testing Station, St. Thomas-street, Sheffield.

IT is reported from Madrid that the Spanish Government has entered into a contract with Señor Don Bernad, Chief of the Forestry Institute, for investigations and experiments, and for the erection at Torrelavega in Northern Spain, of an experimental plant for the manufacture of a commercial gas from eucalyptus wood. The patented process is said to be both effective and economical, a heavily loaded motor omnibus having been run from Madrid to Barcelona, a distance of some 400 miles, at a cost of 10 pesetas, or about 5s. The conversion plant will have three ovens, each being used for a different phase of the experiment. The ovens are described as being of simple construction and as being made of metal plates and rings of sheet iron, dismountable and easily moved. The first official experiments will be made with a Panhard and Levassor 5-ton lorry.

THE annual meeting of the Military Engineers' Association of Canada was held in Ottawa on April 7th, when the question of affiliation with the Engineering Institute of Canada was considered. The executive was instructed to take the matter up with a view of forming a military section of the Institute, and the following officers were elected:—Patron: Col. the Hon. J. L. Ralston, Minister of National Defence. Vice-patrons: Major-General E. C. Ashton, Lieut.-Col. J. P. Fell, and Col. Henry Harrison. Hon. president: Brigadier Clyde Caldwell. President: Lieut.-Col. W. P. Willgar, Montreal. Vice-presidents: Lieut.-Col. A. T. MacLean and Lieut.-Col. C. S. L. Hertzburg. Hon. Secretary-treasurer: Major F. H. Emra. At a banquet held in the evening the principal speaker was Major-General J. H. MacBrien, president of the Aviation League of Canada, who dealt with the great progress made in flying since its beginning in 1909, in which Canada had fully shared. More than 6,000,000 miles of Canadian territory were flown over by aircraft last year, while the freight carried totalled 37,000 lb., and the mail service amounted to more than 791,000 lb., which was five times the figure for 1927. Major MacBrien outlined the flying operations of the Government and stressed the necessity of still further developments in the field of aviation.

THE MANUFACTURE AND TESTING OF ELECTRICAL INSULATORS

STEATITE AND PORCELAIN PRODUCTS, LTD., STOURPORT, WORCESTERSHIRE

(*For description see page 580.*)

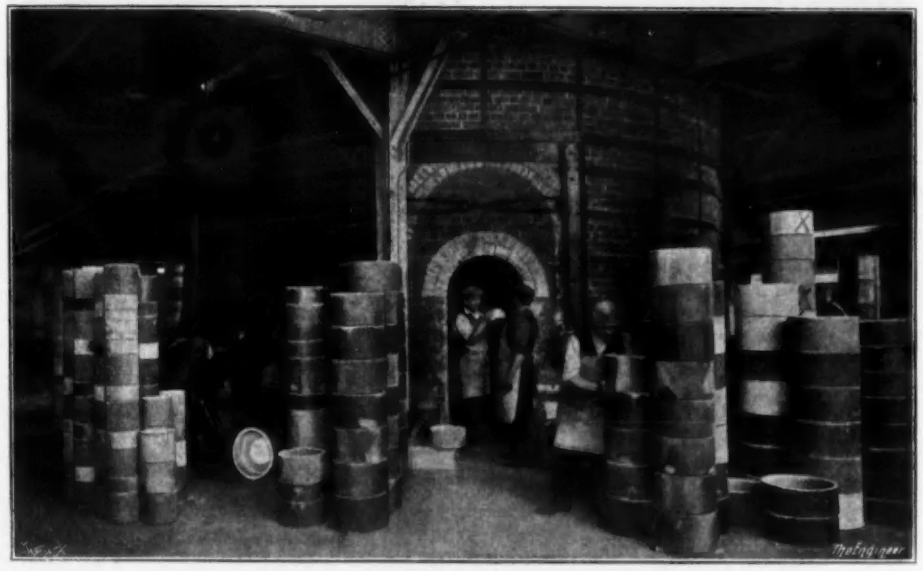


FIG. 16—ROUND KILN FOR FIRING PORCELAIN

FIG. 17—STEATITE HAND-PRESSING DEPARTMENT

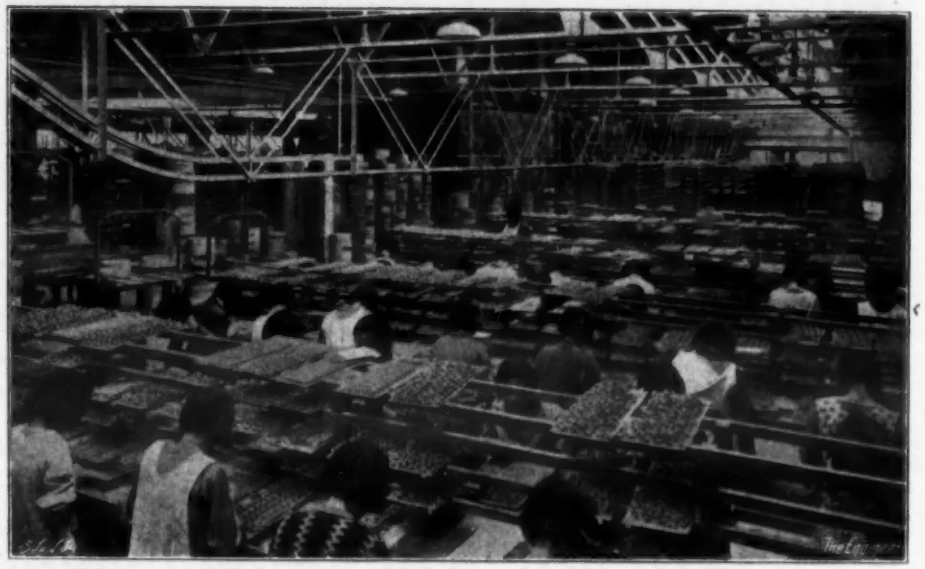


FIG. 18—TRIMMING STEATITE PRESSINGS BEFORE FIRING

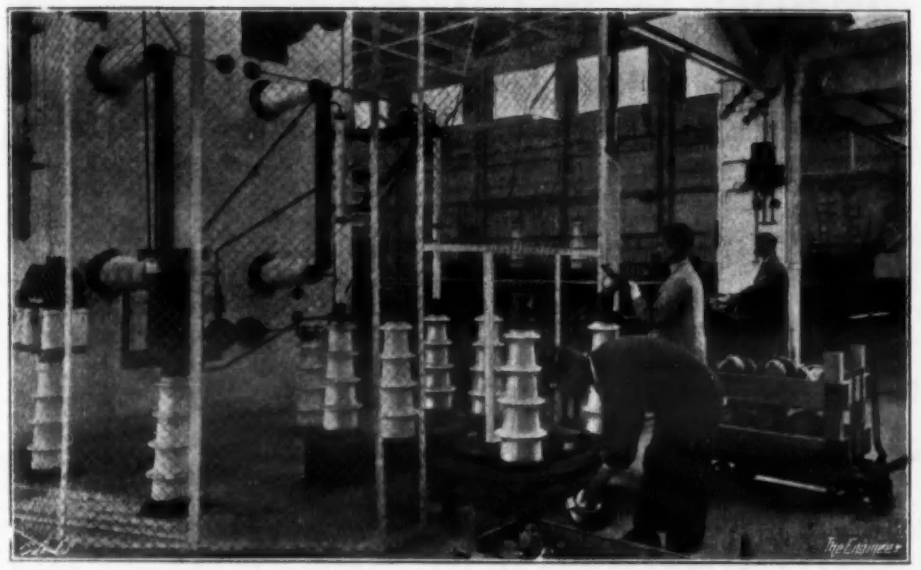


FIG. 19—HIGH-FREQUENCY ROUTINE TESTING EQUIPMENT

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THE ENGINEER.

VOL. CXLIX No. 3880

MAY 23, 1930.

Employment and Rationalisation.

ON Wednesday last one million and three-quarter people in round numbers were known to be out of employment in the United Kingdom. Assuming that the insured industrial population stands at roughly twelve million persons, as it did in July last, that means that at the present time about fourteen and a-half workers in every hundred are out of work. Out of that number about eleven are permanently unemployed. In times of ordinary prosperity in past years there was little or no permanent unemployment, but the temporary unemployment, caused by change of occupation, casual labour and so on, amounted to a figure somewhere in the neighbourhood of three to three and a-half per cent.—not very different from what it is at the present moment. It is not known with anything approaching precision what the prevailing rate of permanent and temporary unemployment in the United States is, but there is no doubt that it is very high. In 1928, according to *Recent Economic Changes in the United States*, there were 43,445,000 employable persons in America, and at that time 2,632,000 were unemployed. More recent figures are not available, but if we accept the estimate of six millions out of work which was given semi-officially a few months ago, then the unemployment in the United States amounts to over thirteen per cent. There are reasons for believing that in Germany and Central Europe similar conditions prevail.

In this internationality of the condition we may find a little comfort. It indicates a world-wide slump, and the slump is a transitory, not a chronic, state. But when the tide of prosperity returns to the world, as it will do, what then will be the position of Labour? The amount of unemployment will fall from the present alarming figure; but to what point will it go back? That is the really vital question which economists have to examine. Only the most hardened optimists believe that, under modern systems of manufacture, the whole potential industrial population of the world can be gainfully employed. We have so greatly increased the productivity of labour, we have so largely diminished the losses which occurred under less acute management and organisation, we have so multiplied factories that even with the utmost efforts of modernised salesmanship it is no longer possible to make consumption keep pace with the potentialities of production. The economic principles of the past have ceased to be trustworthy; no one would dare to say now that markets are unlimited and can always be found as long as prices fall. Turning once more to *Recent Economic Changes*, we find that between the years 1899 and 1925 the "physical volume of production" in all industries in the United States increased by 174·6 per cent., whilst the number of persons engaged augmented by 89 per cent.; that is to say, the output per person rose by 45·3 per cent. in twenty-six years. The actual position is made clearer if we take a shorter period. If we say that in 1919 one hundred persons could produce one hundred units of volume, we find that, in 1925, 92·4 persons could produce 128·5 units. If the old economic principle had held good, then the lowering of selling price which nearly always accompanies increased output per person ought so to have augmented the demand that a greater number of persons would have been employed; what is called "technological unemployment" in America should not have supervened. That was what happened for many years, and it is because there is a cessation of it that real anxiety about the future prevails. There seems, indeed, to be little or no probability that the world will ever again be able to find full employment for all its industrials as long as the present conditions obtain. This is the fundamental problem which demands investigation. It is fruitless to toy with it by relief works in our parks and on our roads; it is uneconomic and injurious to continue the dole system indefinitely; no system of emigration can be more than a temporary palliative, for in time the Dominions themselves become producers. What, then, is to be done? To put a brake upon the progress and development of industries, either technological or managerial, is out of the question. Heavy taxation is doing that in this country already, and we see the result. Sir Oswald Mosley has suggested that the volume of labour should be reduced by lengthening school life and pensioning everybody at sixty; the shortening of the hours of work to six has been advocated by many people. With regard to the former it is desirable to keep an open mind; not to dismiss the scheme as chimerical. It might be more prudent to spend a million pounds a week and more upon old age pensions than to support younger potential workers on the dole. The reduction of the working day to six hours is certainly impossible under the present conditions, but on the other hand, two five-hour shifts without overtime might be practicable. That plan would, indeed, greatly increase employment, but we cannot forget that it would also increase output, and until means of disposing of more products is found there would be little advantage in that.

Although employers and employed regard work as a means to the same end—the making of an income—they do not see it in quite the same light. To the employed a factory is only desirable because it gives employment. To the employer labour is an undesirable necessity; he would do without it if he could; he is continually searching for means whereby he can reduce the amount of it required for a given output. From their own standpoints it is just as impossible not to sympathise with the men—like those who protested against rationalisation in the shipyards last week—as not to sympathise with the employers. The men charged the masters with thinking only of dividends, forgetting that if there were no dividends there would soon be no shipyards. Their ideal is, no doubt, factories run only for the benefit of the labour employed in them. Into that ancient fallacy we cannot enter here. The masters reply that it is better to run two shipyards at a profit than three at a loss; an unanswerable contention, but one that makes the problem of unemployment shine in a clear light. The elimination of wasted effort must continue; the progress of the mechanisation of industries cannot be stopped; the ability of the world to consume is not increasing—*pace* Mr. Ford—as rapidly as its power to produce. Hence the threat of a large measure of permanent unemployment in all countries. The American volumes — *Recent Economic Changes in the United States*—from which we have quoted above were compiled in an effort to get to the bottom of the problem. They are neither very conclusive nor very satisfactory, yet we are convinced that only when a proper scientific attempt is made to understand all the issues involved shall we be in a position to suggest

a radical cure. To apply the remedies may demand higher courage and greater statesmanship than any democratic country can command; but, at any rate, it would be better to know the cure than continue in the present state of ignorance.

The Steaming Economiser.

THERE is probably no unit of plant used in boiler-houses which has retained its original form so long and become so widely adopted as the Green's economiser. It was invented with the idea of usefully employing the waste heat in the flue gases for heating the feed water, and so efficiently did it perform this duty that any substantial improvement in design appeared almost impossible. As a consequence of higher steam pressures, and particularly of the development of the marine type water-tube boiler for land purposes, steel tube economisers built integrally with the boiler have come into service, but to the credit of the old design it may be remembered that it was adopted by Mr. Adams for the Padiham power station, which now holds the absolute record for efficiency in the British Isles. The boiler maker has come to regard the economiser as part of his own province, and he has developed designs to suit his own requirements. Whatever position or structural form the economiser may be given, there is, however, a fundamental difference between it and a boiler. The latter depends for its efficiency upon a rapid circulation. The faster the water can be induced to make its circuit from the drum, through the tubes, and back again, the better is the boiler. As a consequence of this circulation, the whole of the heating surface is maintained at a practically uniform temperature, regardless of the progressive cooling of the gases in contact with it. In no circumstances, therefore, can the boiler, however great its heating surface may be, absorb further heat from the flue gases after these have been reduced to the temperature of the steam being generated. In the economiser, as there is no circulation of the water, there is no such limitation. In the ideal design the water would flow steadily in one direction, while the flue gases flowed steadily in the other, so that in spite of the increasing coolness of the gases they would always be in contact with metal which was cooler still. Heat could therefore theoretically be abstracted from the gases until they were reduced to the temperature of the incoming feed.

This distinction between the scope of a boiler and an economiser would seem to point to a fairly clear line of demarcation between the functions respectively allotted to them. The boiler, one might argue, should be restricted to the duty of supplying the necessary latent heat for the evaporation of water already brought up to its evaporating temperature by the economiser. But practical considerations prevent the adoption of such a simple rule. The rate of heat transmission is much less in an economiser than in a boiler, partly on account of the less temperature difference between the gases and the water, and partly because of the relatively slow water velocity. This lower effectiveness of the heating surface inclines the designer to restrict the proportions of the economiser in order to avoid undue cost. Another thought also influences him in the same direction. By arranging for the economiser to deliver water at the steam temperature, the density of the water throughout the boiler would be uniform and the whole of the boiler heating surface would be steaming surface. This may be very nice in theory, but such a condition obviously is antagonistic to the definite and rapid circulation of the water which all boiler designers aim at. Possibly too much weight has been given to this objection, for the violent turbulence which must be caused by the generation of steam everywhere at once may be equal in value to a rapid but more orderly flow. However this may be, the fact remains that, up to the present, it has been the custom to arrange for the economiser to deliver its water at a temperature far below that prevailing in the boiler. In an important plant set to work within the last three years, the designed difference was as great as 190 deg. Fah., while a margin of 130 deg. Fah. or more may be considered usual. The desire to keep down the cost of the economiser may have done a good deal to establish this practice, but probably a much more potent reason was the fear of approaching conditions which would result in the formation of steam in the economiser. Such an event, in the case of economisers of ordinary design, would not be regarded with complacency by the boiler house staff. Their point of view would be that what a boiler needs to be fed with is water, not steam, quite apart from the operating troubles and possible dangers which steam in the economiser tubes might cause. It is clear, on the other hand, that provided an economiser were so designed that any steam formed could escape freely to the boiler drum, the water flow to the drum being at the same time regular and controllable, no operating difficulties need be feared. The only question that arises is whether there is anything to be gained by thus making the economiser encroach upon the functions of the boiler. Of recent years the opinion has been held in certain quarters that an economiser might advantageously be used in this manner, and the steaming economiser has therefore entered the field of practice. Owing to its comparative novelty, very little information has as yet been published on the subject. For this reason, the data given by Messrs. Humphrey, Buist, and Bansall in their recent paper on the Billingham power plant, read before the Institution of Electrical Engineers, are of some interest. Each of the Billingham boiler units is designed to generate normally 215,000 lb. of steam per hour at a pressure of 715 lb. per square inch absolute, from water fed to the economiser, at a temperature of 401 deg. Fah. The total heating surface of the boiler, including that in the furnace, is 10,020 square feet, to which must be added an economiser surface of 23,030 square feet. The relatively enormous size of the economiser will be at once remarked, as in modern practice an economiser has rarely more than half as much heating surface as the boiler to which it is attached. In return for its size, the economiser is said to contribute about 30 per cent. of the total steam production of the unit. Its further advantages are said to be a saving of space, and the elimination of baffles in the boiler, with a consequent reduction in the fan power required.

The authors of the paper above referred to have unfortunately given neither actual working nor test results which would enable the performance of the Billingham plant to be appraised, for the technical data, added as an appendix, would seem to include rather the intentions of the designer than results achieved. Since there is no other plant in the country producing steam at the pressure and temperature employed at Billingham, and few, if any, boilers of equal output, comparisons with other stations are difficult. The recent paper by Messrs. Guy and Lamb, however, giving very full details of the design and performance of the boilers at Barton, invites a contrast between the economiser practice at the respective plants. Confining ourselves to the pulverised fuel boiler at Barton, which by reason of its firing arrangements, water-cooled furnace, and air preheater, is somewhat comparable with the Billingham design, calculations show that its rate of heat transmission, including the economiser, is about 6205 B.Th.U. per square foot. For Billingham the figure works out to 6903 B.Th.U., an improvement of some 11·3 per cent. Against this, the economiser at Manchester reduces the temperature of the flue gases to 177 deg. above that of the incoming feed, whereas at Billingham the difference is 199 deg. Fah. Considering the difference in the steam and feed water conditions in the two power houses, there is not very much to be deduced from these figures; at all events they cannot be held to prove the superiority of either plant. What is striking, however, is the contrast between the parts played by the economisers in the two cases. At Manchester the economiser has a surface amounting only to 31 per cent. of that of the boiler, whereas at Billingham the proportion is as much as 230 per cent. The small Manchester economiser does its duty with a heat transmission rate of 1742 B.Th.U. per square foot, against 1250 B.Th.U. given for the Billingham one, the latter figure being somewhat difficult to reconcile with the claim that the economiser in question furnishes anything like 30 per cent. of the total steam. Taking it as correct, the rate of heat transmisison per degree of mean temperature difference, which, after all, is the best criterion, is only about 3·35 B.Th.U. per square foot, a figure often surpassed in the old cast iron economisers of a generation ago. The corresponding rate for the Manchester economiser works out to 7·07 B.Th.U. per square foot per degree, or more than twice as great. Other comparisons might be made and other deductions drawn from the published data, the advocates of each design no doubt finding something to justify their respective faiths. But what engineers really want at the present time are more facts to go upon. It is hardly likely that a boiler unit comprising a steaming economiser can be more efficient, thermally, than one following more usual lines, for the limit of possible efficiency has been practically reached. If, on the other hand, it can be shown to be cheaper or more advantageous in any other way to cause the economiser to act partly as a steam generator, we may be on the eve of far-reaching changes in boiler design.

The International Railway Congress.

No. V.*

MEETINGS OF THE CONGRESS.

WE closed our last article by remarking that the discussion on Question VII., Electric Locomotives for Main Line Traction, was concluded on May 12th. The conclusions had not, however, been definitely arrived at at that time, as a committee was appointed to draft them out for submission to Section II. when it resumed its sittings on Wednesday, the 14th. That was done, but it will suffice if we reproduce only the last of the four conclusions. It reads:—"The Congress also notes that, from the point of running and regularity of service, recently constructed electric locomotives give satisfactory results. It requests the various companies and administrations to regularly and freely publish the results of operations on their electrified lines and to publish the results of operation with a view of helping other administrations in the study of new applications of electric traction."

The discussion on all-steel coaches—THE ENGINEER, May 16th—which followed was taken in the best attended meeting of any of the sections. The special report in that case was prepared by Monsieur Lancrenon, the assistant engineer for rolling stock of the Northern Railway of France. It opened with the statement that considerations of safety are, in themselves, sufficient to justify the use of metal construction. That, at once, provoked Mr. Gresley to join issue over such a conclusion; he did not agree that safety was the main consideration. British railways had had experience of coaches built of steel and of those built of wood; both of the open type. The carriages were identical in every respect and passengers could not tell the difference. But those made of metal were higher in cost and weighed more. The stability depended upon the thickness of the metal, but if that were made lighter in order to reduce the weight, those advantages would disappear. Again, American and German experience was based on the open type of car, but that did not apply to British conditions, which call for compartments and corridors. There had been no experience as to the results of collisions on steel cars of the compartment type.

Mr. E. Dahnick, of the Deutsche Reichsbahn, said that in 1914 the German railways had some steel stock with compartments and side doors, but they were abandoned, as the type of car was considered unnecessary. Answering a question by Mr. Koller, of the Czechoslovakian Railways, as to the relative price, Mr. Dahnick said that when wooden coaches were replaced by steel the latter were made longer and generally improved. The cost was possibly 50 per cent. more, which, in view of the higher prices since the war, meant that there actually was no difference in the price. Monsieur Lancrenon here observed that Mr. Gresley saw, or could have seen, all-steel third-class coaches, with compartments and side doors, on the Nord Railway.

Mr. E. J. H. Lemon, carriage and wagon superintendent, London, Midland and Scottish Railway, remarked that the Americans had gone in for heavy all-steel cars in order to reduce the number of passengers killed in accidents. He would like to ask whether anyone had decided what stresses were necessary to withstand the effect of collision. The speeds differed, and a coach that would withstand a collision at 30 or 40 miles per hour might collapse were the speed 60, 70, or 80 miles per hour. He, himself, was dubious as to what would happen to passengers who found themselves imprisoned in a steel compartment after a collision. Monsieur Renevey observed that the French railways were decidedly of the opinion that steel coaches were much better than wooden.

At this stage an appeal was made to any delegates present from American railways to give their experience as to the effects of collision. As there was no response, Mr. R. P. Wagner related some details he gathered when in the United States two years ago, which were to the effect that, in collision, wooden coaches were liable to telescope, but those of steel were thrown out of line and the impact effect spread.

Reference, later, to the subject of aluminium permitted Mr. Dahnick to observe that a train of coaches in which aluminium would be extensively employed was being built for the Berlin Metropolitan Railway. In a discussion as to cost, Monsieur Lancrenon would have it remembered that his experience only covered from five to ten years. On that point the section agreed that the conclusion should read that the results so far obtained have been encouraging.

In THE ENGINEER of May 16th we dealt with marshalling yards. The special reporter thereon was Mr. C. R. Byrom, the general superintendent of the London, Midland and Scottish Railway. The subject was, in a sense, noticeable for the fact that whilst Monsieur Lancrenon required only seven conclusions for

* No. IV. appeared May 16th.

his report, Mr. Byrom needed thirty-three. The discussion was practically confined to French-speaking and German-speaking delegates, and was remarkable by reason of the faith placed by the former in the slipper or shoe, and by the latter in the rail brake, *e.g.*, the Frölich. But, as the Chairman, Monsieur Le Besnerais, said in his summing up of the discussion, that present experience did not yet allow of a definite choice being made between these two methods and their different types. Some, moreover, in spite of the ingenuity shown, called for improvement.

The Congress was brought to a conclusion at noon on Thursday, the 15th, when the Prince of Asturias took the chair. The President of the Congress, in announcing that the next meeting would be held at Cairo in 1933, observed that invitations had been received for the thirteenth Congress to be held in Canada and in Japan. Whilst grateful for these kind invitations, the present Congress could not act upon them, as it was for the 1933 session to decide where the next meeting should be.

Obituary.

TELFORD PETRIE.

By the untimely death of Dr. Telford Petrie, the engineering world is deprived of a man of much ability. Dr. Petrie, who was only 47 years of age, died at his home at Lymm, Cheshire, on Monday last following a very brief illness. After leaving Rugby School he studied engineering at Leeds under Professor John Goodman. He received his practical training in the engine and boiler shops which were founded by his great-grandfather, the late John Petrie, at Rochdale. Subsequently he worked for a year in the shops of the General Electric Company at Schenectady, U.S.A. When he returned to this country he was employed for some time on the business side of engineering with a London firm and was for some years a member of the outside inspection staff of the Crown Agents for the Colonies. Dr. Petrie came into greater prominence when, in more recent years, he was on the lecturing staff of the College of Technology, Manchester, where he was engaged until he was appointed only two years ago to succeed Mr. Strohmeyer as chief engineer to the Manchester Steam Users Association, a society founded, as most of our readers are aware, in 1854 by Sir William Fairbairn for the purpose of preventing steam boiler explosions by competent scientific inspection. During and since his connection with the Manchester College of Technology, Dr. Petrie had taken a considerable part in the work of the Steam Nozzles Research Committee of the Institution of Mechanical Engineers and was largely responsible for the final report, which he presented in an able manner to the Institution during the past session. He was a Doctor of Science of Manchester University and a member of the Institutions of Civil and Mechanical Engineers.

Literature.

Sulphuric Acid and its Manufacture. By H. A. AUDEN, M.Sc., Ph.D. Longmans, Green and Co. 1930. Pp. 231, large 8vo. 16s.

WHEN one considers the large number of excellent text-books on this subject which exist, it seems *a priori* difficult to see what requirement may be filled by a small treatise of this kind. The author's explanation that the large text-books are too expensive for the ordinary student of applied chemistry is somewhat weak, as these books, like "Beilstein" and others of the same kind, are part of the equipment of all technical school laboratories. His second suggestion, viz., that a book of this kind may stimulate research is decidedly better, though this is one of the subjects applied to which research in the ordinary sense is useless, as practically all difficulties are met with during manufacture on a large scale for the first time. Hence, from this point of view the book must appeal to those actually engaged in the manufacture of sulphuric acid, and the reviewer thinks that the author has succeeded on this point fairly well, actual points of interest cropping up here and there in an otherwise quite conventional text. The historical and statistical notes at the beginning are somewhat meagre and totally disregard the intimate connection between sulphuric acid manufacture and the Leblanc soda process, which, undoubtedly, spurred chemists on to make the acid cheaper and cheaper.

It is a matter of taste as yet whether one describes sulphuric acid manufacture as independent of the alkali trade or not, but historically the two go together. The author attaches significance to fuming or Nordhausen acid, as leading up to the use of oleum for concentrating more dilute acid, a procedure made feasible by the introduction of the contact process of to-day. As a matter of fact, the main query of to-day is: Will it pay better to make dilute acid by the chamber process and concentrate, or to make concentrated acid or oleum by the contact process and eventually dilute? Alternatively, can the two processes be worked together more economically than either of them separately? The author has supplied a fair amount of material for investigating these points, or maybe to sketch out a method for doing so.

It would serve no purpose to follow the fairly comprehensive description of the chamber process with its details of pyrites and sulphur burners, Gay-Lussac, and Glover towers, &c., though one might point out that the use of patent drawings with references is of little use to a student, to whom one fairly detailed set of drawings of a well-established design is almost indispensable. To cite an example. On page 61 there is a reference as follows: "The application of high-tension discharge to separate both dust and fume from gases is extending. It is likely that the employment of such types of apparatus as those associated with the name of Cottrell will become more general (Figs. 14–15)." Apart from references to original papers, that is all. The subject is certainly reverted to on pages 177 and 178, but there is nothing to give a student a mental picture of this highly interesting new practice. One must, however, excuse the author's brevity on account of the small space he allowed himself, but as he has done very well in uniting terseness with lucidity in, say, his excellent description of the Glover tower and its function, one might have expected something similar to be the rule. The main thing is that the author shows that the working of the chamber process has been made so economically perfect up to the point at which the acid leaves the Glover tower, that further economy is confined to diminishing the cost of the plant and of its maintenance. Attempts to achieve this end by Lunge and others are briefly described. After some notes on the purification of the acid, he devotes Chapter XIV. to discussing the concentration of the Glover tower acid to 1·84 sp. g., by far the most important problem left for workers with the chamber process to solve. He shows how the modern intermediary plant uses three principles, viz., reverse flow of furnace gases and acid with top-heated horizontal large surfaces, reversed flow in the same way against finely sprayed acid, and, lastly, the application of film evaporators. This chapter is written without detailed reference to thermo-dynamical considerations, and the descriptions of the various forms of plant are far from lucid, but there is a great deal of food for thought in seeing so many departures brought together in a few pages. How can, for instance, such a thermo-dynamical absurdity as the Webb beaker concentrator be even considered to-day? Only the practical worker knows how positively wicked sulphuric acid becomes as concentration and temperature increase, how towards the end possible losses of acid mean more than reduced fuel economy, and how contamination which so easily occurs in large apparatus adds another risk if one becomes obsessed with fuel saving only. Here one would have liked to see the author's views expressed in a few sentences for the benefit of students.

The final chapters on the contact process are very good indeed, but as the success or otherwise of this process with its modifications is so entirely dependent upon seemingly trivial details; which are as yet secret, the author confines his attentions mainly to generalities. A serious omission is that there is no attempt to compare the cost of production with that of the chamber process. It may be that no authentic figures of costs are as yet available, or perhaps the author purposely leaves it to the reader to form an opinion for himself, but if the book is intended for students intent on research, something of the kind ought to be added in a future edition.

The theoretical part of the text is not very attractively put together, and such a jumble of graphs as that on page 14 is hardly to be commended. Otherwise this book forms very interesting reading to the expert, and if made slightly less laconic, it should also be suitable for students.

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Rhodesian Mining and Engineering Year Book, 1930. London: Argus South African Newspapers, Ltd., 72, Fleet-street, E.C. 4. Price 12s. 6d. net.

Foundations for Gas and Oil Engines and Other Machinery. By E. L. Parry. London: Charles Griffin and Co., Ltd., 42, Drury-lane, W.C. 2. Price 7s. 6d. net.

Annales des Ponts et Chaussées, 1930. Fasc. I. Janvier–Février. (*a*) Partie Administrative; (*b*) Partie Technique. Paris: A. Dumas, 6, Rue de la Chaussée-d'Antin.

Les Sources de l'Energie Calorifique et la Chauffage Industrielle. By E. Damour. Paris: Librairie Polytechnique Ch. Béranger, 15, Rue des Saints-Pères. Price 110f. net.

Report of the Railway System of Tanganyika Territory. By Brigadier-General F. D. Hammond, C.B.E., D.S.O. London: The Crown Agents for the Colonies, 4, Millbank, E.C. 4. Price 5s. net.

Annali dei Lavori Pubblici (già Giornale del Genio Civile), Ministero dei Lavori Pubblici, Consiglio Superiore. Anno LXVIII., Fasc. No. 2, Febbraio, 1930. Rome: Provveditorato Generale dello Stato, Libreria. 1930.

Oil Circuit Breaker Films.

ON Friday, May 16th, an exhibition of films relating to oil circuit breakers was given by British Brown-Boveri, Ltd., and A. Reyrolle, Ltd., at the St. James Picture Theatre, Palace-street, London. The Brown-Boveri films, which are the outcome of considerable research, showed the whole process of rupturing heavy currents under oil. By means of trick films the fundamental phenomena that enter into the process of rupturing such currents were clearly portrayed, and were confirmed by slow-motion pictures of the actual rupturing in a specially constructed circuit breaker with heavy glass sides illuminated with flood lights of 200,000 candle-power. The development of the arc and the gas bubble during the rupturing process was demonstrated. In the first tests that were shown on the screen, 10,000 kVA at 8000 volts were broken by means of a single pair of contacts, and it was seen that gases were produced from an opaque ball which rapidly increased in size, while the oil above the contacts was thrown against the cover. For heavier loads the character of the breaking process is essentially the same, but accentuated. This was demonstrated by the next test, in which 24,000 kVA at 8000 volts were ruptured, this capacity being in excess of the rupturing capacity of the breaker. The oil reached the cover quickly and expelled all the air, and the static pressure increased rapidly and quickly caused the glass walls to give way.

Films of tests on a breaker fitted with an explosion chamber were then shown, 10,000 kVA at 8000 volts being interrupted. The explosion chamber was provided with lateral circulating ports, and it was seen that carbonised oil escaped through the ports before the moving contact had left the explosion chamber. The same capacity was also broken with the explosion chamber provided with circulation holes at the top. The formation of the oil piston was clearly demonstrated, and the shock to which the breaker was subjected caused an oil leak.

For the next test multiple break contacts were used, and it was noticeable that the duration of the arc and the work done were diminished. The test involved the rupturing of 10,000 kVA at 8000 volts by three pairs of contacts in line, and clearly demonstrated the advantages of the multi-break principle. The next portion of the film gave a representation of the magnetic field produced by the arrangement of the contacts in an oil circuit breaker when closed on a short circuit. The effect is that powerful repulsion occurs between the contacts, and, as a result, they tend to open again. Owing to the unevenness of the contacts it is found on close examination that they only touch on a small portion of their surface. The magnetic lines consequently follow the current, and are loop-shaped, and repulsive forces are set up between the contacts. These forces are sufficient to separate the contacts, especially when closing breakers on short circuit currents exceeding 10,000 ampères. The arcs thus formed damage the contacts and often cause them to weld together.

A slow-motion picture of a glass-walled breaker showed the effect of the repulsion of solid contacts under oil, and it was seen that owing to the magnitude of the repulsive forces the circuit was broken twice in succession and part of the copper of the contacts was melted and dispersed into the oil. Finally, the contacts were welded together. It was also demonstrated that repulsion and welding can occur with the plug type of contact, but that contact repulsion can be prevented by the use of solenoid contacts wound in the same sense, so that they attract one another. With this object in view, British Brown-Boveri and Co., Ltd., have developed contacts of this form, dimensioned so that the effect of all the repulsive forces is balanced by the attractive force, and these solenoid contacts make it possible to close a breaker without danger on very heavy short-circuit currents. To demonstrate this, a picture of a normal circuit breaker was shown, equipped with three different types of contacts, and each was closed, in turn, on a short-circuit current of from 30,000 to 50,000 ampères. One pole was equipped with brush contacts and ordinary arcing contacts; another with plug contacts; and a third with solenoid contacts. The film demonstrated that in the cases of the brush and plug contacts a considerable amount of oil and gas was ejected from the tank, but, when the solenoid contacts were closed, the only visible indication that a heavy current had passed was the violent movement of the cables connected to the switch. The film also showed that the brush and plug contacts had been considerably damaged and burnt away, whilst the solenoid contacts were undamaged.

The film shown by A. Reyrolle and Co., Ltd., which firm has also carried out a great deal of research work, demonstrated the manufacture, testing, and installation of metal-clad switchgear. Speaking after the Brown-Boveri film had been shown, Mr. Brierly, of A. Reyrolle and Co., Ltd., said that the film dealt entirely with research, and he thought everyone would agree that it showed in a remarkably clear way the various phenomena which occur when a circuit breaker had to break current and also when it had to make and momentarily carry a heavy short-circuit current. The film had shown the necessity for very great care in design in order to secure adequate making capacity, and it would be interesting to see in the Reyrolle film a photograph of Reyrolle "self grip" contacts after completing a circuit carrying 70,000 peak ampères at 17,000 volts four times in succession. The views of Brown-Boveri and A. Reyrolle and Co., Ltd., Mr. Brierly explained, had developed on parallel lines, for although the actual details of construction might not be exactly identical, both firms advocated open type circuit breakers embodying the multi-break principles for high-power high-voltage switchgear. Research appeared to have proved the wisdom of advocating multi-break principles in preference to the explosion pot principles adopted in America, and actual multi-break designs were being used for parts of the 66-kV and 132-kV systems in Great Britain.

The Reyrolle film included some views of the high-power short-circuit test plant recently built at Hebburn for the purpose of carrying out further research work with considerably greater powers than have hitherto been available in Great Britain, and the film included an actual oscillograph record of one phase of a three-phase short circuit obtained on the Hebburn testing plant. The initial peak current was 70,000 ampères.

The Manufacture and Testing of Electrical Insulators.

No. II. (*Conclusion*).*

HAVING described in the previous article the high-tension research laboratory at the Stourport Works of Steatite and Porcelain Products, Ltd., we will now pass to a discussion of the many interesting processes and machines employed by the company in the manufacture of its products. These products are chiefly electrical insulating ware, although, as we remarked previously, the company still does a considerable amount of business in the manufacture of incandescent gas mantle rings and nozzles.

A keynote to the planning and operation of the factory will become apparent as our description proceeds, namely, the necessity for cleanliness and the avoidance of contamination of the raw materials with foreign matter, particularly iron or other metals, which would be destructive of the desired high grade insulation of the products. This consideration affected the choice of a site for the new factory. The site selected at Stourport is adjacent to the Great Western Railway and lies close to the banks of the Severn at the farthest point up that river to which it is navigable for barges of 110 tons. This site offered the advantages of that clear atmosphere which is so essential for the manufacture of high-grade porcelain. It is about 70 acres in extent, has easy access to the important distributing centres of Birmingham and Manchester, has communication by barges with Gloucester and Avonmouth for export, is close to some of the best deposits of fireclay in England (Stourbridge), and is adjacent to a number of coal pits supplying coal of quality suitable for electrical insulator manufacture.

The factory was designed for a smooth flow of the products through the works with a minimum of handling and labour costs from the point at which the raw materials are unloaded from the railway trucks, or from the conveyor from the river Severn, to that at which the finished goods are loaded on to the railway or road lorries. With the exception of the raw materials preparation buildings and silos, in which it was desirable to make use of gravity flow in order to save handling, the factory is a single-storey steel-frame building with north light and asbestos sheet roofing. In pursuit of the ideal of cleanliness the whole of the internal steel work has been painted with white enamel, so that the first sign of rust or dirt can be detected and corrected. The first unit of the factory occupies a floor area of over 4 acres, and in its design provision was made for the eventual duplication of its output by extensions to the original buildings.

PORCELAIN MANUFACTURE.

The principal raw materials for the manufacture of high-tension porcelain are China clay from Cornwall, plastic kaolin (ball clay) from Dorset, quartz and felspar from Norway. These materials are delivered to an unloading bay, where the railway line is brought to a level higher than that of the factory floor. Even with the exercise of the utmost vigilance it is difficult for the suppliers of China clay to ensure that this material is always of the same quality and chemical composition, even when it is taken from the same part of the same mine. Before delivery is taken of any consignment, it is carefully sampled from the truck and analyses are made and compared with the standard analysis. When the bulk has been passed by the chemist, the raw material is unloaded by means of a belt conveyor direct into storage bins. From the storage bins each raw material is unloaded in the same manner into a breaking or disintegrating machine built under the floor of the storage building.

Each disintegrating machine has incorporated in it sifting plant. The coarse material is returned to the machine and only the raw material broken to a standard degree of fineness is allowed to pass through to the elevators, from which it is discharged into any one of twenty-two concrete silos, each holding 30–40 tons. In addition to the analyses made of the consignments of raw materials as they are delivered, further samples are taken from the bins and again from the breaking machines and silos, and these representative samples are then analysed separately, so as to ensure that each silo contains a definite raw material of known composition and of a predetermined degree of fineness. A point of considerable importance in regard to the control of the purity of the "body" is the fact that there is no communication between the storage building and the preparation building except over the silo floor on which an automatic weighing machine is situated. It is therefore impossible for any raw materials other than those which have been carefully weighed out to become accidentally mixed with the "body."

From the silos the raw materials are delivered through ebonite-lined mouthpieces to the automatic weighing machine — Fig. 20 — which is controlled through a combination lock set by the works manager. This machine, which weighs up to 2 tons of the mixture at a time, has an accuracy of ½ lb., or 0·01 per cent. Unless the knife edges are correctly balanced for each material, corresponding to the figure on the combination lock, the mixture cannot be discharged to the grinding mills. This arrangement ensures that the proportions of the various ingredients in the body are accurate to within 0·1 per cent. For control an examination is made of each batch of raw material, standard test pieces being made and their electrical and mechanical properties determined. Each charge is also tested to determine the relative degree of fineness of the particles which it contains.

From the weighing machine the mixture is discharged through apertures in the floor directly to the grinding mills, which are placed in a row beneath the silo bank. There are four of these mills. Each is built of steel ¾in. thick, lined with porcelain blocks 5in. thick. The balls used in them are not of steel, as usual in cement and other mills, but are selected flint pebbles. The grinding is carried out for a definite number of revolutions. The ground raw material is blown out of the mills by compressed air into porcelain lined stirring vats—see the Supplement. On its way to the vats the material passes through a set of magnets and a set of sieves. In the vats water is added to the dry material until it becomes sufficiently liquid to be pumped to a filter press. For three or four hours it is subjected to a standard pressure. When no more water can be extracted, the press is opened and the cakes are dropped directly on to a truck wheeled beneath the press. The cakes, having a uniform mixture and a known water content, are then transferred to storage cellars, where they are kept under conditions of constant humidity for three or four weeks, in order to increase the plasticity of the body.

To eliminate any entrapped air and bring the whole of the material to a uniform consistency the body passes through the kneading machines—see the

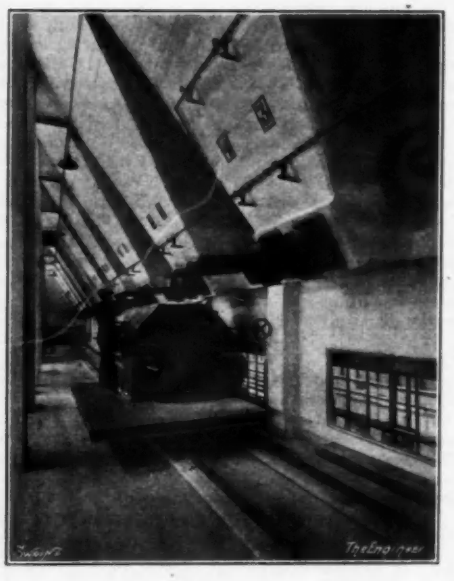


FIG. 20—AUTOMATIC WEIGHING MACHINE

Supplement. Blocks from the kneading machines—see Fig. 21—are then carried on elevating trucks to the throwers and moulders, who in a series of operations transform the wet body into the shape which the insulator is finally to take. The clay is first made into balls, which are thrown into sugar loaves. The loaves are then beaten into plaster moulds, which are handed to a second worker, who sets them on his wheel and with the aid of profiling tools works the insulator to shape on what will be its underside. The insulator is allowed to dry slowly and is then passed to the third worker, who finishes the underside, and finally to the fourth worker, who removes it from the mould and shapes the outside surface. The turning and moulding shop is illustrated in the Supplement.

The exact shape of the porcelain is of the utmost importance, and samples of the finished insulators in the wet state are taken at frequent intervals during the day. Sections are cut from them and all measurements checked against the standard drawing to ensure that there shall be no variation through the wearing of the tools or moulds or other causes. If there is any variation from standard dimensions the tools are at once returned to the toolroom for correction or new standard tools provided, as a variation of only a few hundredths of an inch in the important dimensions may seriously affect the electro-mechanical strength of the insulator. After the insulators have been finished and stamped with the maker's number and date they are transferred to steel racks and carried on elevating trucks to the drying stoves, where they are slowly dried for periods varying according to the shape and thickness of the insulator. These drying stoves are sealed and air is circulated, commencing with a high degree of humidity which is gradually diminished while the temperature is gradually increased, so that the insulator dries from the inside outwards, and any casual cracks which would lead later to electrical puncture are avoided.

After drying, the insulators are glazed on a glazing machine with a highly refractory felspathic glaze, the exact composition of which and its expansion relative to the body have an important bearing on the ultimate mechanical strength of the insulator. The insulators are now ready for firing.

As it is undesirable for the insulators to come into direct contact with the flames in the kiln, they are enclosed in saggars made of highly refractory fireclay. It is important to ensure a long life for these saggars, and the composition of their body is therefore of very great importance. The plant employed is fed from special saggar silos containing ground and graded raw materials, and measures out accurately the quantity of each material, mixes the body and elevates it to a wet mixing plant from which it is directly extruded for the use of the saggar maker. The saggars are formed in plaster and cast iron moulds by a process very similar to that employed in the making of the insulators themselves. They are then dried and fired by the waste gases produced in the firing of the porcelain.

For firing high-tension products the factory has at present, in addition to the tunnel kiln shown in the Supplement, two round kilns of the down-draught type—see Fig. 16, page 576—which are provided with double doors, so that pieces up to 8ft. high and 3ft. 6in. diameter can be fired. It is not possible to fire large insulators of this type in the tunnel kiln. The bulk of the high-tension goods, however, are fired in the tunnel kiln, which is 320ft. long and carries at any one time fifty trucks of goods. A continuous chain conveyor travelling at a speed of two miles an hour brings the goods to a low-level unloading platform from which the trucks are directly charged. These trucks are then transferred by means of transfer wagons to the tunnel kiln itself. The capacity of the kiln is one truck per hour, and it is equal to fifteen round kilns. The tunnel kiln is fired by means of clean pure producer gas of constant composition at constant pressure. The gas is generated by means of two rotary producers which have long pre-distillation chambers ensuring the production of a rich gas. These producers are situated in a separate building and the gas before use passes through cooling and scrubbing towers to remove completely tar and foreign matter. The composition and pressure of the gas are controlled by recording calorimeters and a pressure equalising plant.

The tunnel kiln is provided with fifty-six burners, each of which is capable of independent adjustment to regulate the temperature and the condition of the gas in the kiln at any point. The temperature at all points is controlled by five recording platinum-rhodium pyrometers, and as a further check frequent readings are taken with a Féry optical pyrometer. Seger cones are, in addition, mounted on each truck, which also carries test cups which are removed and examined at intervals during the progress of the truck through the kiln. Analyses of the composition of the gas and of the flue gases are made regularly to control the nature of the atmosphere of the kiln at all vital points.

After unloading from the kilns the insulators are first carefully examined for mechanical or glazing faults, and any which are not perfect are immediately rejected. The insulators are then transferred to the routine electrical testing tables, where they are tested for fifteen minutes at their flash-over voltage. The routine testing plant — described hereafter — is equipped with transformers for 300,000 volts.

In the meantime each piece of steel and malleable iron which is to go to make up the assembled insulator, for instance, caps, pins, &c., has been tested to 50 per cent. above its working load. Every insulator is, after assembly, tested mechanically to 25 per cent. above its working load, and is then subjected to an impulse voltage of up to 200,000 volts and a high-frequency test of 150,000 volts at 120,000 to 150,000 cycles per second. After these tests, in which any failures are rejected, the insulators are again tested as a matter of routine on the testing tables for fifteen minutes at their flash-over voltage.

In addition, a definite proportion of each batch of insulators is sent to the research laboratory for flash-over, ultimate electro-mechanical strength, ultimate mechanical strength, and porosity tests, and finally for puncturing under oil.

THE MANUFACTURE OF STEATITE GOODS.

The basis of porcelain is China clay, a naturally occurring aluminium silicate. Steatite is a magnesium silicate which is found native in many parts of the world. Practically all these steatites consist of a combination of magnesium oxide and silica in varying degrees of purity, but the proportions vary enormously. The factory obtains its steatite from Holenbrunn, in Bavaria, where deposits exist of an average depth of 20ft. over an area of 2400 acres.

Steatite has a very much higher tensile and bending strength than porcelain, and for high-tension work was first used for types of insulator in which the ceramic part is actually in tension and where, therefore, a very high tensile strength is needed. Of equal importance to its application to high-tension work is its employment for wireless telephony and for the production of pressed articles of a very high order of accuracy and strength.

Steatite when finely powdered can be pressed together in the perfectly dry state to give an article which is sufficiently strong to be dropped on to a travelling band, and on this basis automatic pressing machines have been devised by the Steatit-Magnesia Company, in which some hundreds of millions of

* No. I. appeared May 16th.

pieces per annum of pressed steatite articles of highly complicated shape are pressed. These machines are entirely automatic in their operation and employ tools of a very high order of accuracy so that they deliver articles which require practically no cleaning and, being dry, can be sent on the automatic conveyor direct to the kilns.

The contraction of steatite on firing at 1450 deg. Cent. is very much less than that of porcelain, being 8 per cent. as against 18 per cent., and this fact is a further assistance in enabling steatite articles to be supplied to a high degree of accuracy. Steatite articles can, in fact, be supplied commercially with a tolerance of only 2 per cent., as compared with 5 per cent. and upwards in the case of porcelain.

Just as special precautions were taken to ensure that there was no contamination of the porcelain body, it has been arranged that there is no possibility of the admixture of steatite and porcelain. The ground steatite body from the mill is driven by compressed air directly to a building which is remote from the porcelain preparation building. There it is separated by means of a filter press, the cakes are dried, disintegrated, ground, and delivered in varying degrees of fineness for use in the pressing machines. Steatite does not come into contact with the porcelain until the two go in separate saggars into the tunnel kiln. After firing at 1400 deg. to 1500 deg. Cent. the steatite goods are unloaded and returned to the conveyor for transfer to the glazing department. Here the goods are first carefully examined for faults and the perfect pieces sprayed with a leadless glaze and passed through a tunnel muffle kiln at 970 deg. to 1000 deg. Cent. Where necessary they are marked with indelible glazed lettering which is fired on in a special kiln. The goods are then after further testing and inspection packed for dispatch. The present capacity of the low-tension pressing department is upwards of 200 million pieces per annum.

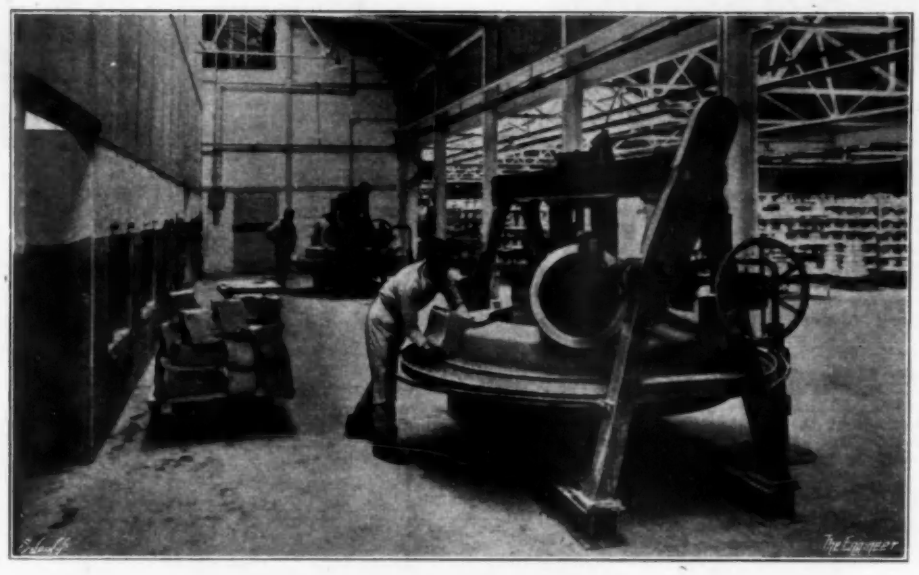


FIG. 21—UNLOADING A KNEADING MACHINE

In the steatite department hand presses are also employed, and in Fig. 17, page 576, we illustrate this section of the works. Fig. 18, on the same page, shows an adjoining section in which the products—gas mantle rings, in the foreground—are cleaned and trimmed after pressing and before firing. Fig. 18 also illustrates the chain conveyor, which passes throughout the works at a slow continuous speed descending to a convenient level where necessary for loading purposes.

THE ROUTINE TESTING EQUIPMENT.

For the continuous testing of all goods manufactured in the factory a routine testing room has been built. The testing room is situated at the exit of the tunnel kiln so that all procelain emerging from it automatically passes to the testing plant. There are four testing tables—see the Supplement—on which tests with normal frequency alternating current up to 150 kV against earth or 300 kV between insulated poles can be carried out. One of these tables is of special construction for the testing of exceptionally large pieces.

Besides these routine testing tables there is equipment for continuous high-frequency and impulse tests as well as a special machine—illustrated in the Supplement—for routine mechanical tests on suspension insulators. Although the impulse and high-frequency tests are not usually specified as routine tests in this country, they are being generally used on the Continent and in America, and are specified in the testing regulations of the A.I.E.E. They are probably the severest routine tests which it is practicable to apply to an insulator. The maximum peak voltage which can be obtained from the equipments provided at the Stourport factory is approximately 300 kV. For higher test voltages plant is available in the high-tension laboratory. By means of a rotating table it is possible to carry out continuous tests in such a way that several thousand pieces can be tested in a day—see Fig. 19, page 576.

It was necessary that the arrangements of the high-tension connections and testing transformers should be such as to secure continuous testing. The testing transformers are fed normally from a single-phase generator, the driving motor of which is connected to the factory mains. The primary voltage of the testing transformers was, however, chosen so that they could be connected directly to the mains in case of breakdown of the motor generator set. The voltage is controlled in both cases by means of a sliding-core regulating transformer connected in series with the primary windings of the testing transformers. Under normal conditions each transformer supplies voltage to one pair of testing tables, but arrangements are made to cross-connect the transformers should one be temporarily out of action. All the high-tension connections and change-over switches are protected by wire-mesh guards, and are placed so high above the testing tables that there is no possibility of danger to the men working in the testing room. The room is equipped with all possible safety devices for the protection of those working at or near the testing tables. For instance, each separate testing field is closed by doors which cannot be opened while an electrical connection exists between a testing transformer and that particular field. Alternatively, voltage can be applied to a testing table only if the doors of the testing field which is at the moment connected to a transformer are closed. The door locks are in the form of no-current switches, so that in the event of failure of the source of supply to these locks it is impossible to work in the testing room.

In the impulse plant two high-voltage condensers are charged by an unsmoothed unidirectional current which is obtained from a mechanical rectifier fed from the high-tension side of one of the transformers. For the high-frequency plant a special bank of oil-filled glass condensers is used which is charged directly with alternating current. The discharge in this case takes place through a quenched spark gap and the primary of a Tesla transformer, both of which are connected in series across the condenser bank. The quenched spark gap is so built that the voltage can be easily regulated, and so designed that it can be used for continuous tests. A very simple switching operation is required to change immediately from impulse tests to high-frequency tests.

For temperature cycle tests two immersion tanks, one providing ice-cold water and the other boiling water, are available in which a large number of insulators can be simultaneously put through the test and in which exceptionally large porcelains, such as high-voltage bushings, &c., can easily be dealt with.

It is greatly to be regretted that many organs of the daily Press, in publishing accounts of the Stourport factory and laboratory, should have succeeded in distorting the information supplied to them by the company in several respects which may react harmfully on other British manufacturers of electrical insulating ware. We were not present at the official opening of the laboratory on May 15th, but on May 12th, throughout the whole day, we were in contact both with the officials of the company and with the representatives of the Press who visited the factory for the purpose of acquiring information concerning its history and activities. As impartial observers, fairness to the company demands that we should express our conviction that it is in no way responsible for the misleading statements published by certain contemporaries. It is quite unnecessary to tell our readers that the establishment of the Stourport factory does not represent "the foundation of a new British industry." They already know that both porcelain and steatite insulators of all sizes and types have been successfully manufactured in this country for many years past and that that industry has not been the monopoly either of Germany or America. From the evidence contained in our own columns our readers are well aware that it is far from correct to say that "hitherto the British Empire has had no adequate research plants for work on high voltage." Nor will they be misled by the assertion made in at least one paper that "steatite is a dry powder found only in Bavaria." For this error the company cannot be held in any way to be responsible. Its author, like ourselves, was shown the steatite arriving at the factory in solid lumps and being ground to a powder after receipt. Like us, he was handed a printed book which stated that "steatite is found native in many parts of the world," and that "only at one place has steatite so far been discovered which is suitable for the manufacture of electrical insulators." He was told verbally that the company obtained its steatite from Bavaria. The company did its best to instruct the Press in this and other matters, and it is to be regretted that erroneous statements should have been made which may prove injurious to British and Empire industries.

The Institution of Municipal and County Engineers.

THE fifty-seventh annual general meeting and conference of the Institution of Municipal and County Engineers is to be held at Scarborough from July 9th to 12th next. The following programme has been arranged:—On Wednesday, July 9th, there will be a special general meeting at the Olympia, Scarborough, at 10 a.m., which will be followed at 10.15 a.m. by the annual general meeting, at which the chair will be taken by the outgoing President, Lieut.-Colonel E. B. Martin, D.S.O., M. Inst. C.E. After the transaction of the usual business, the Scorgie Challenge Shield will be presented to the District contributing during the past year the largest amount per member to the Widows' and Orphans' Fund, and the Carter Challenge Shield will be presented to the District contributing during the past year the largest amount to the Widows' and Orphans' Fund. At 11.15 a.m. there will be a meeting of subscribers to the Widows' and Orphans' Fund. At 11.45 a.m. visitors and delegates will be admitted, and the chair will be taken by the outgoing President, Lieut.-Colonel E. B. Martin, D.S.O., M. Inst. C.E. His Worship the Mayor of Scarborough (Councillor A. Moore, J.P.), will then welcome the visitors. Mr. J. P. Wakeford, M. Inst. C.E., Borough Engineer of Stockton-on-Tees, will then be installed President of the Institution, and deliver his Presidential Address. The subject of the thesis for the Richard Pickering Medal and Prize for the year 1930–31, and the award of premiums will then be announced.

In the afternoon the following visits will be paid:—(*a*) To places of interest in Scarborough, including the sea wall in course of construction, beach bungalows, bathing establishments, cliff lift, Corporation cafés, and new tennis courts. (*b*) To places of interest in Scarborough, including the Rose Gardens and Italian Gardens to the Bathing Pool, beach bungalows, sea defence and cliff works, the Spa, and Peasholm Park. (*c*) Irton waterworks, *viâ* Hackness and Forge Valley. (*d*) Bridlington. (*e*) Forge Valley, Hackness, Silpho Moor and Cloughton. (*f*) Forge Valley, Hackness, Silpho Moor and Cloughton. In the evening at 8.30 p.m. there will be a reception by the Mayor and Mayoress of Scarborough (Councillor A. Moore and Miss Moore) and the Mayor and Mayoress of Stockton-on-Tees (Alderman and Mrs. F. T. Nattrass), which will be followed by a dance.

On the Thursday, the Conference will be resumed at the Olympia at 10 a.m. After an address by Colonel C. H. Bressey, C.B.E., Chief Engineer, Roads Department, Ministry of Transport, the following papers will be discussed:—(1) "The Holborn Explosions and Fires, December, 1928," by Mr. J. E. Parr, A.M. Inst. C.E., Borough Engineer and Surveyor, Holborn; (2) "Post-war Developments in Scarborough," by Mr. H. W. Smith, A.M. Inst. C.E., Borough Engineer, Scarborough; and (3) "The Purification of the Water of Swimming Baths," by Dr. H. T. Calvert, M.B.E., Chemical Inspector, Ministry of Health. In the afternoon the following papers will be taken:—(4) "The Waterworks Undertaking of the Tees Valley Water Board," by Mr. G. R. Collinson, M. Inst. C.E., Engineer, Tees Valley Water Board; (5) "Some Notes on Estimating the Cost of Public Works," by Mr. W. Muirhead, M. Inst. C.E., Westminster. All papers will be taken as read. The annual dinner will be held at the Grand Hotel, Scarborough, at 7.15 for 7.30 p.m.

On the Friday, the following visits will be made:—(*g*) York; (*h*) Hull; (*j*) Bridlington, *viâ* Flamborough; and (*k*) Whitby. In the evening at 7.30 for 7.45 the Ladies' Festival of the Municipal and County Engineers' Lodge, No. 3920, will be held at the Spa, Scarborough. Dinner and dance.

On the Saturday, July 12th, 1930, there will be a third tour of places of interest in Scarborough, including the Mere, Peasholm Glen, bungalows, dressing boxes, tennis courts and the Castle.

FOLLOWING the installation of a similar light on the Winnipeg store, the Hudson's Bay Company has announced the installation of a 3,000,000 candle-power aeronautical beacon on the Calgary store to be visible for 130 miles. Forty neon tubes, each 20ft. in length, will be arranged vertically around the special tower above the store, while a beam light will illuminate Calgary's air port.

Electric Totalisator at Newmarket.

AN electric totalisator of similar design to the demonstration equipment installed at the Thirsk racecourse on January 28th of this year, was successfully operated at the Newmarket races, commencing with the Craven meeting on April 23rd. Whilst the Thirsk totalisator was only suitable for six horses, however, the equipment tested at Newmarket allows for a total of forty-five runners in any one race. Before it was used for the first time at the Craven meeting, it was subjected to severe trials, and officials of the Jockey Club and Racecourse Betting Control are said to have expressed their entire satisfaction with the general performance. The totalisator was worked at four times its normal capacity, and every conceivable test was applied at all points of the course.

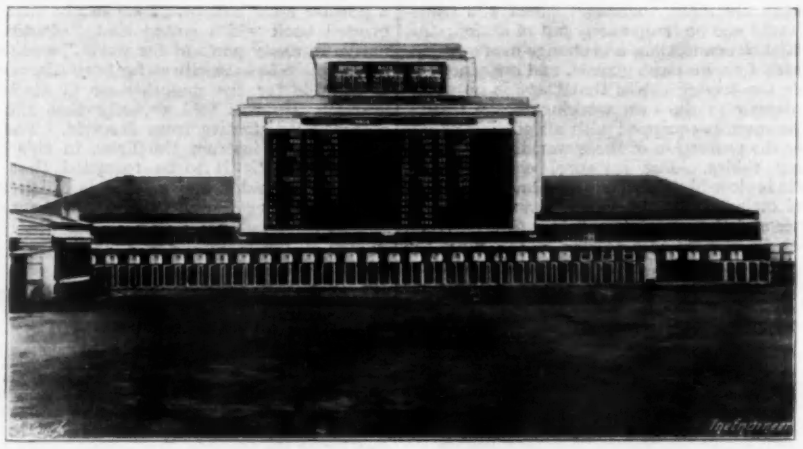


FIG. 1—INDICATOR BUILDING

The manufacturers were the British Thomson-Houston Company, Ltd., and the Automatic Telephone Manufacturing Company, Ltd., which were also responsible for the equipment installed at the Thirsk racecourse on January 28th. With the exception of certain ticket-issuing machines which are situated at various parts of the course, the entire equipment is housed in the indicator building shown in Fig. 1, which gives a divided display. The equipment incorporates two well-known components of the Strowger automatic telephone equipment, namely, the horizontal automatic relay and the heavy-duty rotary line switch, both of which have been well tested in every-day public telephone service. Groups of this equipment with individual dustproof covers, and slip-on covers for protecting the wiring and terminals, are shown in Fig. 2.

The progress of a bet through the machine is as follows:—The backer approaches the window of any one of the

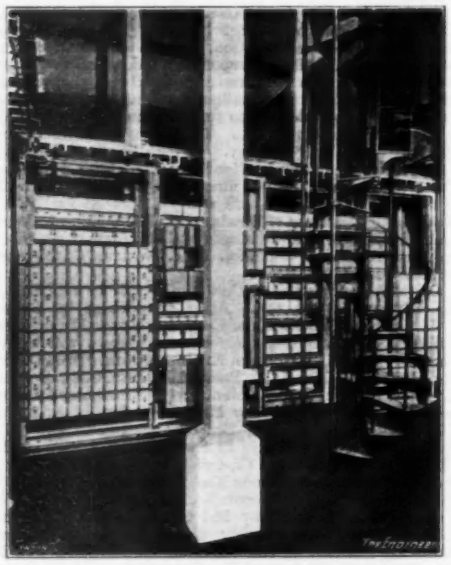


FIG. 2—INTERIOR OF INDICATOR BUILDING

ticket-issuing booths, each of which contains two ticket-issuing machines, marked with the denomination or value of a stake, such as 10s. When he has nominated his horse for a "win" or a "place," a clerk depresses the corresponding "horse number," and discriminating keys on the ticket-issuing machine, and a printed and dated ticket, bearing a record of the stake, is issued to the backer. The ticket-issuing machine is so controlled, however, that the ticket cannot be issued until the bet has been accepted and recorded by the corresponding horse-adding machines and total-adding machines. As the numbers of the horses in any one race are not necessarily consecutive, owing to withdrawals or scratchings on the eve of the event, the two ticket-issuing machines on each booth can deal with 1–40 and 41–80 corresponding horse numbers respectively. An interior view of a ticket-issuing booth, of which there are 100 on the Newmarket course, is shown in Fig. 4. For the most part, these booths are arranged along the sides and one end of the indicator building, but some are distributed in the Tattersall's enclosure, Silver Ring, trainers' quarters, and in the paddock verandah. Five denominations or stake values are provided—the 2s. unit, 10s., £1, £10, and £100. These values are clearly indicated on the booths, and the backer selects a booth corresponding to his stake, quite irrespective of the number of his fancied horse.

The ticket-issuing machines, which were supplied by the Bell Punch and Printing Company, Ltd., incorporate Strowger relays and a special coding device. The number of wires between these machines and the main equipment in the indicator building is reduced to a minimum. There are, in fact, only ten wires per machine. In effect, the ticket-issuing machines are miniature printing presses, embodying the required selectivity, impulse generation and control. They are fool and fraud proof, and immune from the detrimental effects of atmospheric changes. Depression of the keys of these machines in accordance with the requests of the backers closes electrical circuits and sets in motion a chain of Strowger electro-mechanism terminating in the registering and indicating devices, which keep the public informed of the progress of betting preceding each race. The first set of components of the main equipment to receive electrical impulses initiated by the ticket-issuing keys are the "place change over" relay groups, which discriminate between "win" and "place" bets before they reach their respective adding machines for registration. Next in order come the decoding relay groups, shown in Fig. 3, which transform the key signals into their betting equivalents and pass them on to the collecting switches, which are Strowger heavy-duty line switches, and their function is to collect the bet signals from the various ticket-issuing machines.

While the betting is in progress, these switches are in continuous rotation at a speed of about 50 revolutions per minute, and the brushes traverse 2400 contacts per minute. This high speed provides ample margin for the prompt acceptance of bets during the busiest pre-race period when all the ticket-issuing machines may be in use simultaneously.

The final link in the chain of mechanism associated with each runner is the horse adding machine—a combination of Strowger heavy-duty rotary line switches and relays, which aggregates the bets received from the collecting switches and transmits the resultant totals to the indicator for visual display. In addition to the two horse-adding machines for each runner for adding "win" and "place" bets, there are two total "win" and "place" adding machines that total up all bets and pass them on to the total display panels on the indicator, where the ratio between these grand totals and those of the respective runners gives an indication to the public of the odds prevailing at any instant. During the busiest pre-race period, the various totals change very rapidly and several adding machines are in continuous operation, but owing to the simplicity of the circuits and the absence of any need for electrical synchronisation of switches, the utmost accuracy is assured.

The indicator operates on the lamp monogram principle. Each unit or lamp box comprises a bank of twenty-four B.T.H. Mazda lamps, which from luminous figures controlled by a Strowger relay control group that operates in accordance with signals transmitted from the adding machines. Each lamp is light-insulated from its neighbour, has a blackened background, and is surmounted by a blackened grille, with the result that the illuminated figures are clearly visible in a direct sunlight from a distance

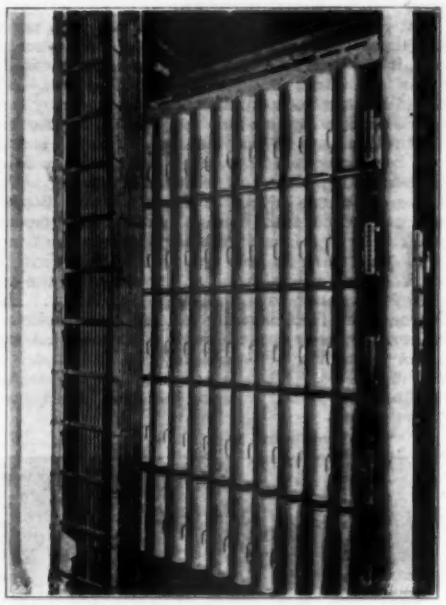


FIG. 3—DECODING RELAYS

of 150 yards and at any angle up to 30 deg. The complete switching equipment operates at 50 volts, and the current when the equipment is in full operation ranges from 300–400 ampères. As the indicator is duplicated on the opposite side of the building, it is visible from the Tattersall's enclosure and from the Silver Ring. Current for operating the totalisator is derived from storage batteries mounted on motor lorries, which are maintained in a charged condition by a portable 8 horse-power Petter crude oil generating set.

The control board—Fig. 5—which is situated on the ground floor of the indicator building is the key to the entire totalisator installation and enables the fullest possible control over the betting to be carried out, if

FIG. 4—TICKET-ISSUING BOOTH

necessary, by one individual. The board is equipped with a number of keys and corresponding signal lamps, one key representing each horse and each total adding machine, *i.e.*, "win" or "place" respectively. Betting is started by manipulation of the corresponding keys at the control board. Thus, if both "win" and "place" betting are permitted, the total "win" and total "place" keys are operated and are followed by the actual runners. If there is no "place" betting, the "place" keys are left in the normal position, and it is impossible for the ticket-issuing machines to accept "place" bets. Restoration of the "horse" and "total" keys to the normal position immediately stops all betting, as the issue of tickets is controlled from the adding machines, and a horse-adding machine cannot remain in service unless the corresponding

ELECTRIC TOTALISATOR AT NEWMARKET

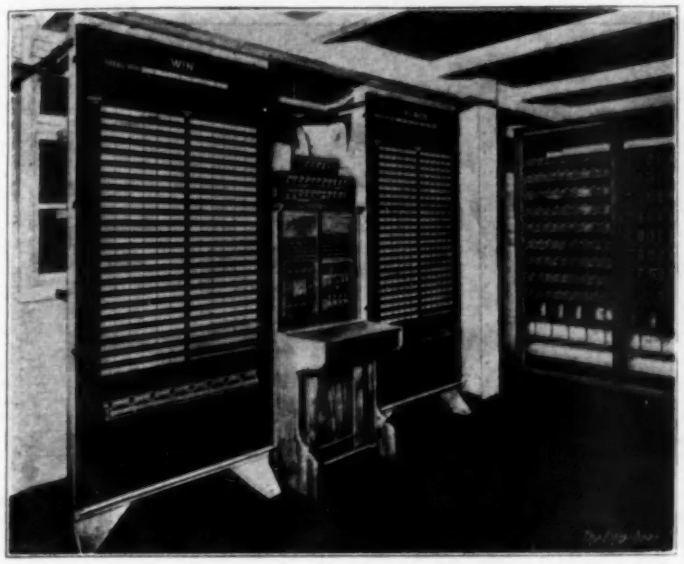


FIG. 5—CENTRAL CONTROL BOARD

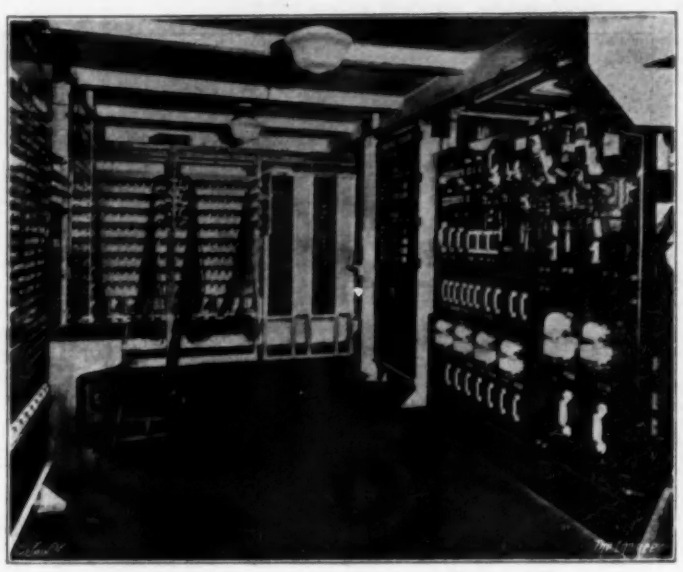


FIG. 6—GENERAL VIEW OF CONTROL ROOM

total adding machine is also working. As long as the keys are in the operating position, a signal lamp associated with each key glows and enables the controller to see at a glance what part of the equipment is working and registering bets. On each side of the control board there are miniature "win" and "place" indicators which reproduce the indications on the main indicator and thus keep the controller informed of the progress of the betting.

A general view of the control room is given in Fig. 6. On the left the central control board and miniature indicators are to be seen; in the middle, the plugging-down racks and dividend and horse number display rack; and on the right the miniature dividend display indicator and power switchboard. Immediately above the control board there is an arrangement of supervising signal lamps of different colours, which, by lighting under distant control, keep the controller advised of the carrying out of miscellaneous instructions issued by him to the various parts of the course. These supervisory signal lamps are shown in Fig. 7. To the right of the right-hand miniature indicator there are "win" and "place" plugging-down

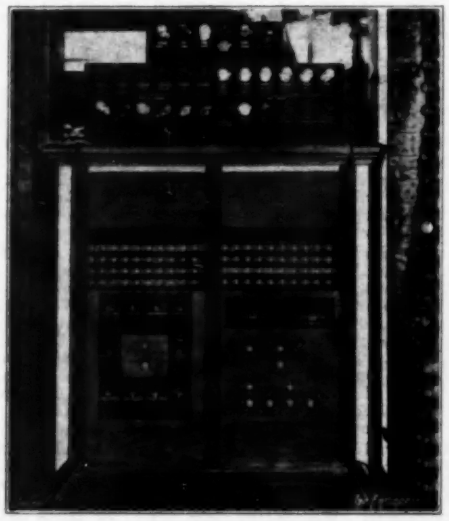


FIG. 7—SUPERVISORY SIGNAL LAMPS

racks that enable the controller to display non-consecutive horse numbers in regular sequence on the main indicator, and thus eliminate gaps which would otherwise occur in the case of non-runners. From this control board, betting can be started, stopped, or modified, and once the control switches have been set for betting in accordance with agreed procedure on any given race, the control board is locked to prevent accidental operation of the control keys or unauthorised interference while a race is in progress. This feature is one of many that effectually safeguard the backer against fraud.

The control room also contains a dividend and a horse number display rack, with a miniature dividend and display indicator arranged for manual operation, and on this indicator the dividend is set up and checked prior to its display to the public on the outside dividend indicator. Display is made to the public by the operation of a switch immediately after the judging and weighing have been completed and officially certified.

A noteworthy feature of this totalisator is its mobility for equipments, such as lamp boxes, change-over groups, decoding groups, collecting switches, horse-adding supervisory groups, and ticket-issuing machines can be erected on site just prior to the meeting, and be either removed to another racecourse or stored immediately after the meeting, without disturbing a single permanent electrical connection; in fact, only the racks, cable and wiring and control room equipment need remain in position. Needless to say, in a country like Great Britain where the racing season is limited, and where certain courses have only one or two meetings during the year, this is a particularly advantageous feature. Notwithstanding the proved reliability of the totalisator, it is desirable to test the circuits of the equipment immediately after its erection and prior to putting the equipment into commission at any meeting, and thus ensure that everything is in order. A fault indicator is therefore mounted in the control room. There is also a subsidiary indicator on each bank of apparatus, and in the event of a fault it is automatically signalled on the fault indicator and located by the lighting up of the subsidiary indicator on the faulty bank. A routine tester checks the operation of every circuit in the various apparatus, and by an adaptation of the Strowger mechanism the complete equipment can be tested under actual working conditions within a period of 15 minutes.

SIXTY YEARS AGO.

THE position of the wood screw industry in Birmingham was exciting considerable interest sixty years ago. In our issue of May 27th, 1870, we recorded the fact that Nettlefold's patent for the manufacture of wood screws was just about to expire, and that the great house of Nettlefold and Chamberlain was threatened with the competition of a new joint-stock enterprise, the Birmingham Screw Company, Ltd. The manufacture of wood screws had undergone a revolution during the preceding fifty years. At one time the screws had been made by a laborious and painful hand process. The wire was cut to length and handed to a smith who forged the heads. Next the nick in the head for the screwdriver was cut by means of a hand saw with fine teeth. Finally, the thread was formed on the shank by hand filing. At a later date some manufacturers gave up the hand-filing process in preference for a method of forming the thread involving the use of dies held together by a heavy weight, between which the workman turned the blank backwards and forwards by means of a winch until the screw was cut to the required depth. The process involved much hard work on the part of the "screw girders" as the people operating it were called. Then, in 1849, a German clockmaker, Colbert by name, introduced steam-driven machinery into the trade. Under his method the wire was placed in a self-acting machine, which forged the heads on cold and cut the blanks to length. The forged blanks were then passed on to a lathe, and their heads turned to size. Thereafter, the nicking was performed by means of a revolving saw. The thread was finally cut on a worming machine, making use of dies which were traversed along the length of the blank by a power feed. In the year named it was computed that about 1700 people were engaged in this country in the manufacture of screws, and that the output was over 70,000 gross per week. In 1854 a patented self-acting machine was introduced from the United States, and quite transformed the industry. The machinery was complicated and expensive, but those who adopted it eventually succeeded in practically monopolising the trade. The machinery comprised means for heading the blanks, turning and nicking the heads, returning the heads to remove the burr thrown up by the nicking saw, and worming the thread by means of a cutter. The handling of the screw between the various stages was performed automatically. Women were employed to feed the machines, one woman attending to several. By 1870 the production of screws at Birmingham, chiefly in Nettlefold and Chamberlain's works, had risen to 130,000 gross per week. The cuttings produced from the nicking and threading processes amounted to about 4 tons per day. Not only was the quality improved by the adoption of automatic machinery, but between 1849 and 1870 the price fell by 50 per cent. It was hoped that the threatened competition would still further lower the price to the consumer.

Institute of British Foundrymen.

THE 27th Annual Convention of the Institute of British Foundrymen is to be held in Middlesbrough from June 17th to 20th next.

The following programme has been arranged:—On Tuesday, June 17th, at 6 p.m., a General Council Meeting will be held at the Constantine Technical College, Borough-road, Middlesbrough; at 7.30 p.m. a reception in the Constantine Technical College will be held by Mr. and Mrs. William Shaw, after which the College will be inspected.

On the Wednesday, at 9.15 a.m., the Conference begins at the Constantine College, where the members will be officially welcomed by his Worship the Mayor of Middlesbrough—Alderman Thos. J. Kedward. The Annual General Meeting of the Institute will follow and the President, F. P. Wilson, will deliver an address. Papers Nos. 1, 2 and 3 on the list given below will then be presented and discussed. In the afternoon visits will be paid to (I.) the Cleveland Steel Works of Dorman, Long and Co., Ltd.; (II.) Smith's Dock Company, and (III.) the works of Head, Wrightson and Co., Ltd., Thornaby. At 7.15 p.m. the annual banquet will be held in the Constitutional Hall, Stockton-on-Tees.

On the Thursday, at 9.15 a.m., the Conference continues, and papers Nos. 4, 5, 6, 7, 8, 9 and 10 will be considered at duplicate sessions. In the afternoon there are to be visits to (IV.) Tees-mouth by river, by invitation of the Tees Conservancy Commissioners; (V.) the works of Dorman, Long and Co., Ltd., at Port-Clarence; (VI.) the works of Richardsons, Westgarth and Co., Ltd., at Hartlepool, and (VII.) the works of Imperial Chemical Industries, Ltd., at Billingham. In the evening at 8.30 p.m., there will be a combined visit to the Middlesbrough Opera House.

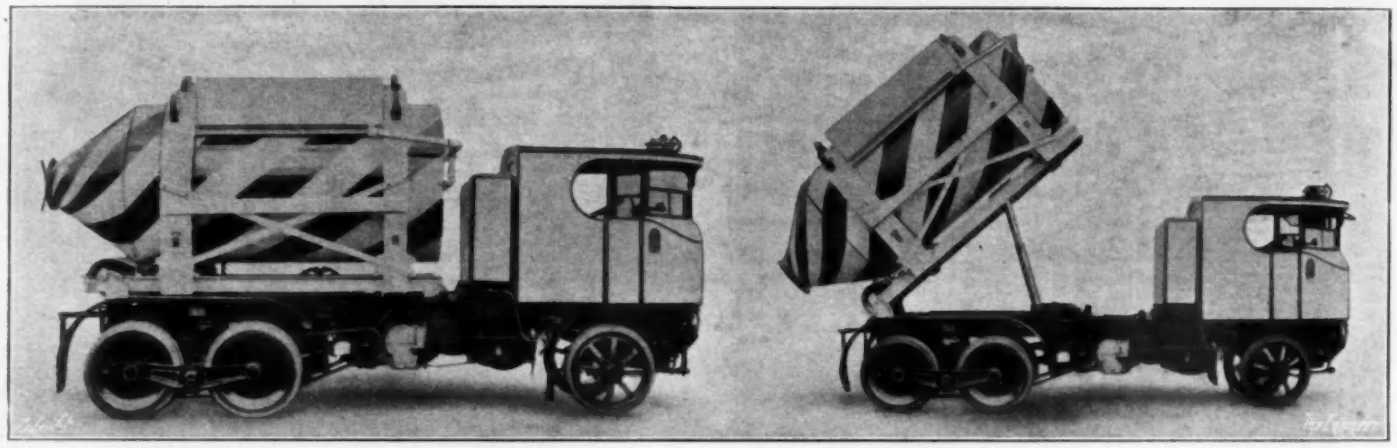
On the Friday, June 20th, starting at 9.30 a.m., there is to be a motor coach excursion over the moors to Whitby, the return being made by Saltburn, where the delegates and ladies will be entertained to a garden party and tea by invitation of Mr. and Mrs. William Shaw. A special programme has been arranged for ladies.

The following is a list of the papers to be considered at the Conference:—No. 1, American Exchange Paper: "Developments in the Use of Briquetted Borings for Cupola Melting," by F. J. Walls, Pontiac, Michigan, U.S.A. No. 2, "The Economic Utilisation of British Pig Iron Resources," by C. H. Ridsdale, F.I.C., F.C.S., and N. D. Ridsdale, F.C.S. No. 3, "The Founding of Bronze Gear Blanks," by F. W. Rowe. No. 4, French Exchange Paper: "The Making of Iron Castings for Heating Apparatus, Stoves, and for General Building Purposes," by H. P. Magdelenat, Vice-president, Association Technique de Fonderie à Paris. No. 5, Belgian Exchange Paper: "The Preparation of Materials for the Converter when used for Steel Castings," by J. Léonard, Ingénieur A.I. Liége, President of the Association Technique de Fonderie de Belgique and Hon. Member of the Institute of British Foundrymen. No. 6, "The Future of the Side Blown Converter in the Steel Foundry," by J. Deschamps. No. 7, "The Utilisation of Compressed Air in Steel Foundry Practice," by T. W. Barley. No. 8, "The Production of Large and Medium-sized High-class Iron Castings," by W. Scott. No. 9, "Reclamation of Oil Sand Cores," by Frank Hudson, and No. 10, "The Factor of *Personnel* with regard to the Future of British Foundry Practice," by Douglas H. Ingall, D.Sc., F.I.C., F. Inst. P., Principal, Constantine Technical College, Middlesbrough.

THE INSTITUTION OF WELDING ENGINEERS.—The Institution of Welding Engineers is offering a prize of £10 10s. and the Gold Medal of the Institution for the best original paper written by a *bond fide* operative welder, either oxy-acetylene or electric process, whether members of the Institution or not. The prize-winning paper will be read before a meeting of the members of the Institution. Further particulars may be obtained on application to the Acting Secretary of the Institution, 30, Red Lion-square, London, W.C. 1.

WAGON FOR DISTRIBUTING READY-MIXED CONCRETE

THE "SENTINEL" WAGGON WORKS, LTD., SHREWSBURY, ENGINEERS



Wagon for Distributing Ready-Mixed Concrete.

THE accompanying engraving illustrates a wagon intended for the distribution of ready-mixed concrete, which has recently been constructed by the "Sentinel" Waggon Works, Ltd., of Shrewsbury, for the British Steel Piling Company, Ltd.

The manufacture and sale of ready-mixed concrete as a commercial commodity came into vogue in the United States about ten years ago. The system was found to have numerous advantages. The seller of the concrete, since he had to maintain his reputation, saw to it that the materials from which it was made were of the best and that only experts were employed in the making, so that the ingredients were always correctly proportioned. By placing his mixing works centrally as regarded places where concreting was going on, his output was sufficiently large to enable him to employ expert operatives. Repeated tests of the concrete produced and delivered under such conditions are said to have shown a quality and uniformity of product superior to those possessed by any concrete mixed on the site, saving in exceptional cases. The task of mixing concrete on the site of the building operations is, as often as not, in the hands of labourers who do not fully realise the importance of the correct proportioning of aggregates, or the significance of the exact amount of water, with the result that a great deal of the concrete which has gone into buildings has been of mediocre quality.

Then, again, the use of pre-mixed concrete was found to be of great convenience to the contractor, since it simplified his organisation by eliminating mixers and the gangs of men required to operate them. It also saved the space which would have been occupied by the mixing plant, and by the cement and aggregate stores. Further, only one material—concrete—had to be ordered, instead of three, and money was not tied up in stocks of materials. In many cases, too, ready-mixed concrete could, it was discovered, be supplied more quickly than the building contractor could use it, so that the work was speeded up.

The system was successful in America, where there are now many central distributing plants in operation. Originally, all the concrete was mixed at the central depot and was dispatched to the point where it was to be used, either in wagons fitted with tipping bodies, or, in the case of larger plants, in special "agitator" bodies. The "agitator" body is an open body fitted with revolving paddles, which are actuated by the engine of the wagon, and the object of which is to prevent separation of the water from the aggregates during transit. A development was the abolition of the mixers at the central depot and the mixing of the concrete on the vehicle while it was in transit to the site. All that was done at the depot was to proportion the component parts of the concrete into mixers mounted on vehicle chassis. It is a vehicle fitted with a mixer which is illustrated in our engraving. The "Sentinel" Company considers that there should be a considerable opening for vehicles of this type in this country.

The vehicle is a "Sentinel" D.G 6, double-geared, tipping model, steam wagon, which is equipped with Bromilow and Edward's patented tipping gear operated by an oil pump driven from the wagon engine. The mixer, which has a capacity of 5 cubic yards, is known as the Paris Transit Mixer—a patented device comprising a cylindrical drum, conical at the discharge end, and fitted with internal blades. The drum is revolved by the wagon engine through the medium of a chain drive, a gear-box, shafting and a pinion meshing with a circular rack attached to it. The drum can be rotated either when the vehicle is in motion or at rest, the engine in the latter case being run free. The mechanism of the mixer comprises a differential transmission; similar to that of a motor car, which allows the drum to be revolved while it is being raised or lowered by the tipping gear. The drum, which may be revolved at from ten to twenty revolutions a minute, is carried on four large ball-bearing rollers on which it is entirely supported, while the rear end of the tipping sub-frame of the vehicle on which it is mounted is hinged to the top of the chassis frame.

Two tanks are mounted on the top of the drum, the larger for supplying water for the "mix," and the smaller for flushing the drum or other purposes.

In operation, the aggregates and cement are weighed and loaded into the mixer drum through an opening at the apex of the conical end. While that is being done, the drum is revolved to distribute the materials evenly throughout its length and to give them a thorough dry mixing. At the same time the exact amount of water, in accordance with the amount of cement used and the consistency required, is measured into the main tank. When the full load of dry aggregate is in the drum the vehicle proceeds to the "job." About five minutes before it arrives at its destination the driver opens a valve and the water in the main tank is sprayed under pressure into the dry "mix." At the same time the mixer mechanism is thrown into gear and the drum starts to revolve, so that, when the vehicle arrives at the site, the concrete is thoroughly mixed and ready for use. If for any reason the wagon has to wait before it can tip its load the drum is kept rotating so that the concrete may not have the chance to segregate.

South African Engineering Notes.

Nitrogen from the Air.

MR. JOHN CHRISTIE, manager of Modderfontein Dynamite Factory, speaking before the Empire Mining Congress at Johannesburg on the explosives industry, as associated with the mines, said that the increasing utilisation of local raw materials rendered the South African industry largely independent of imported products, a position that would be further strengthened within the next two years by the installation at Modderfontein of plant for the synthetic manufacture of ammonia and nitric acid from atmospheric nitrogen. The hydrogen will be manufactured through the agency of coke. Plants for the oxidisation of the ammonia produced in this process into nitric acid, which is required for the manufacture of explosives, will be erected both at the Modderfontein factory and the Somerset West dynamite factory; the total expenditure on both works will be in the neighbourhood of £500,000.

Union Road Construction.

Roadmaking in the Union is proceeding on a huge scale and with considerable rapidity. It is likely to be still further increased owing to the fact that the depression in trade and industry has thrown thousands out of employment, and the most economical way of relieving their distress is by employing them on road construction. One million pounds sterling has been granted to the provinces for this purpose by the Union Government, and the Provincial Councils are themselves spending £200,000 or so each during the financial year. In addition, further money is now being obtained by the Provincial Councils for the same purpose. The Cape Divisional Council is also among the road authorities that are expending large sums on construction of roads. It has just obtained permission to raise £100,000 for the construction of certain main roads. Nearly all the large municipalities are spending heavily in improving the surfaces of their roads to meet the severe wear and tear that motor traffic involves. Germiston is raising £500,000, and though of that sum £250,000 is for a sewerage scheme, a substantial amount will go for roads. Krugersdorp, small as it is, has decided to spend £10,000 on a road improvement programme; Ladysmith is spending an amount that will probably reach £30,000; the Port Elizabeth Divisional Council is energetically proceeding with the improvement of roads in an area recently taken over, and has borrowed £125,000 for the scheme. An important point in connection with all the schemes is the large proportion of the money to be expended that is allocated to road-making plant and machinery. Pick and shovel roadmen are hardly ever seen working on the roads now. One great advantage is the rapidity with which earthen roads can be constructed and afterwards kept with a reasonably good surface, the road grader rapidly restoring any portion which becomes bad through heavy traffic or from the effects of rain.

Proposed Railways Abandoned.

In a special report dated March 24th the Railway Board of the Union of South African Railways recommends to the Minister of Railways and Harbours that the branch lines from Somerset East to Bruintjeshoogte, Martindale to Southwell, and Ficksburg to Groenfontein, should not be constructed. The two first-mentioned lines are in the Cape Province and the third in the Orange Free State. The Somerset East–Bruintjeshoogte and Martindale–Southwell lines were to be 21 and 24 miles in length respectively, and were estimated to cost £106,719 and £142,371 respectively. The Ficksburg–Groenfontein line was to be 17 miles in length and cost £93,534. The Board now states that it realises the importance which must be attached to the revolutionising element introduced by road motor service, and its effects on railway working. The general public do not hesitate to avail themselves of the quickest, handiest, and cheapest means of conveyance, and there seems to be a growing lack of support of the State's railway system, and especially of branch lines, for which there has been such a keen demand in the past. These factors make themselves felt forcibly, and have exercised the Board's mind very considerably when dealing with the lines still to be constructed. It had therefore considered it advisable further to investigate each case on its merits. The Board finds that substantial motor services are now in operation in these districts, so that it is certain that the volume of traffic would fall far short of the estimated figures previously, and even those had shown a loss. The introduction of road motor services has entirely altered the whole outlook, in so far as the establishment of railway communications is concerned, and the Board therefore recommends that the lines be not proceeded with. The Board states that the economic conditions at present prevailing in the Union have not influenced it in coming to this conclusion. Arising out of the facts brought to light as regards lines approved by Parliament, the construction of which has not yet commenced, the Board is now paying special attention to the working of certain branch lines which are being operated at a loss, owing among other things to the activities of private road motor competitors.

THE INSTITUTE OF TRANSPORT.

A CONGRESS and Summer Meeting of the Institute of Transport is to be held at Glasgow from Tuesday to Saturday, July 8th to 12th next. The Lord Provost of Glasgow will extend a civic welcome to the Congress on the morning of Tuesday, July 8th. The following programme has been arranged:—

Meetings at the City Chambers.—Tuesday, July 8th, 10.15 a.m., paper, "Railway Amalgamation and its Effect on the Workshops," by E. J. H. Lemon, Carriage and Wagon Superintendent, L.M.S.R.; Wednesday, July 9th, 10 a.m., paper, "The Economics of Port Development and Administration," by Sir George C. Buchanan, K.C.I.E.; Thursday, July 10th, 10 a.m., paper, "Long-distance Omnibus Services: Their Place in the National Scheme of Transport," by W. J. Thomson, Managing Director, Scottish Motor Traction Company, Ltd.

The following visits and excursions are to be made:—Tuesday, July 8th: (*a*) To the Locomotive and Carriage Works of the L.M.S.R. at St. Rollox, and the L.M.S.R. Locomotive Running Sheds at Polmadie; and (*b*) to the Shipbuilding Yard of John Brown and Co., Ltd., at Clydebank. Wednesday, July 9th: (*c*) Motor drive (morning visit chiefly for ladies); (*d*) to the Works of the North British Locomotive Company, Ltd., at Springburn; (*e*) to the Works of the Albion Motor Car Company, Ltd., at Scotstoun; (*f*) to the test line of the George Bennie Railplane System of Transport at Milngavie; and (*g*) to Gleneagles by invitation of the L.M.S.R. (evening visit). Thursday, July 10th: (*h*) To the Cathedral, University of Glasgow and Glasgow Art Galleries (morning visit chiefly for ladies); (*i*) to the Coplawhill Car Works and the new Motor Garage at Victoria-road, of the Glasgow Corporation Tramways; and (*j*) to the factories of the Scottish Co-operative Wholesale Society at Shieldhall. Friday, July 11th: (*k*) All-day cruise in the new L.M.S.R. turbine steamer "Duchess of Montrose" on the Firth of Clyde, by invitation of the L.M.S.R.; and Saturday, July 12th: (*l*) To the Forth Bridge and Edinburgh.

On the Tuesday, from 7.30 p.m. to 11 p.m., the Lord Provost of Glasgow and the Corporation of Glasgow will entertain the Congress at a reception and dance in the Banqueting Hall at the City Chambers. On Thursday, July 10th, the dinner of the Scottish Section will be held at the Central Hotel.

THE City Council of Lethbridge, Alberta, proposes to expend 200,000 dollars on modernising its steam-driven electric power plant.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Trading Conditions.

TRADING conditions in the engineering and iron and steel industries of the Midlands and Staffordshire remain almost lifeless. Industrialists in all branches of trade report a lack of new business and a settled quietude marks the weekly meetings of the Birmingham Iron and Steel Exchange. A few small tonnage orders for both raw and finished material are being put through, but the steady flow of trade necessary, if production is to be maintained at the works even at the present level, is lacking and it is feared that output will have to be reduced in the near future. General engineers this week say that trade is particularly quiet, constructional firms report no improvement, automobile engineers are progressing slowly and taking regular supplies of material, while the Staffordshire boilermaking firms have a fair amount of work on hand and are able to keep plant fully employed. The heavy edge tool trade is decidedly dull and quiet conditions rule in the nut and bolt industry. Electrical engineering firms are holding their own, but complaints of unremunerative selling prices are rife. Unemployment is becoming more prevalent.

Will Pig Iron Prices Fall?

As the end of the month approaches consumers of pig iron are redoubling their efforts to force blast-furnacemen to revise prices in their favour. The Pig Iron Producers' Association meet at the end of the month to review the position in the industry and the probabilities of a reduction in the fixed selling prices as the result of the meeting are being canvassed in all quarters. Opinions at date are divided, but users maintain that only by a continuance of their policy of limitation of buying can they hope for a satisfactory decision, as any increase in demand for raw iron would only strengthen smelters in their attitude of present price maintenance. Producers have of late taken a very strong stand with regard to prices, and only this week a case is cited when business could have been done if a figure 1s. per ton below the zone minimum had been accepted. Midland furnacemen were not to be drawn, however, and, as a consequence, only very small tonnages required for immediate consumption are changing hands and even they tend to dwindle, users' needs being appreciably less than they were two months ago. There is no competition from outside districts, transport costs being too heavy to permit of successful competition by either North-Eastern or foreign producers. Smelters have no difficulty in getting adequate supplies of coke and odd lots are to be had on favourable terms. Derbyshire and Northamptonshire furnaces maintain a regular output and producers assert that little material is being put into stock. The zone selling prices are rigidly adhered to, Derbyshire forge being £3 14s. 6d.; No. 1 foundry, £4 1s. 6d.; No. 2, £4 0s. 6d.; No. 3, £3 18s. 6d., and No. 4, £3 17s. 6d. Northamptonshire forge is £3 11s.; No. 1 foundry, £3 18s.; No. 2, £3 17s.; No. 3, £3 15s., and No. 4, £3 14s., all per ton delivered Black Country stations.

Poor Demand for Steel.

Business is flat in practically all branches of the steel trade, all the efforts of steelmasters to induce users to increase specifications proving abortive. Activity at the consuming works is restricted and, as a result, producing works have, in some instances, been forced to curtail operations in order to keep the works open. Prices in the finished branches remain firm and there is little probability of any change before midsummer, when the steel manufacturers association will again review the position. In the half-products department an excess of supply over demand has resulted in some weakening of prices, and while as much as £6 5s. per ton is still quoted for English billets, it is claimed that much better terms are to be had when attractive orders are the subject of negotiation. Even £6 per ton is stated not to be the present "rockbottom." Small bars are only in moderate request, but most rollers keep up their price at from £8 upwards, according to quality. Staffordshire hoops sell at £10 at makers' works.

Finished Iron.

There is no new feature in the Staffordshire finished iron trade. Some firms making marked bars in South Staffordshire are doing a steady turnover, and, on the strength of that, are inclined to regard the situation hopefully. But the general state of the finished iron trade is such as to cause considerable anxiety. In the Crown and common bar branches works are on short time and the orders received are of a trifling nature. One consolation makers here have is the knowledge that their competitors are faring as poorly. Makers from outside districts competing for the Crown bar trade secure very little business, while merchants dealing in continental iron competing with Staffordshire nut and bolt bars report a similar lack of results, notwithstanding the fact that they can offer material at nearly £3 per ton below the local makers' price. Inquiries for wrought iron strip have increased during the week and some good business is thought to be in prospect. Iron prices are nominally unchanged, marked bars being £12 10s. at makers' works; Crown bars, £10 to £10 7s. 6d.; nut and bolt and fencing bars, £9, and iron strip, £11 2s. 6d., all per ton delivered.

Galvanised Sheets.

The galvanised sheet trade in this area shows no improvement, the market continuing dull in all departments. Corrugated sheet of 24-gauge are upheld in price at £11 17s. 6d. per ton and there is no alteration in selling values of sheets of other denominations. Both home and export business is poor, and it is commented upon this week that the export of sheets last month did not maintain the moderate improvement which a month previously encouraged millowners to hope that the tide had turned in their favour. In the circumstances, and taking into consideration all the conditions, the difficulties of trading with India and Australia, &c., the month's exports of over 44,000 tons was not as bad by any means as it might have been.

Scrap.

There is practically no business being done in steel scrap and it is almost impossible to determine present values. It was stated on 'Change in Birmingham this week that heavy steel scrap was to be had at £2 8s. per ton, delivered local works. Merchants deny this statement, however. It is a fact that steel works which could actually do with scrap are offering what the sellers consider are ridiculously low prices. Deliveries to South Wales are very few and a number of works are now unable to accept further consignments.

Engineers Visit Sewage Works.

Thirty-five members of the Wolverhampton and District Engineering Society visited the sewage outfall works at the Barnhurst, Wolverhampton, on Saturday last and listened to a short lecture by the manager, Mr. W. Clifford, A.M.Inst. C.E., outlining the general sewage system of the borough. He stated that the average quantity of effluent treated at the works was 4,000,000 gallons per day, and illustrating the difficulties met with, said that three-fourths of it was from factories and only one-fourth from domestic sources.

Unemployment.

The latest unemployment returns for the Midlands area show that unemployment is again on the increase, the figures having risen by 3937 on the previous week, viz., from 236,247 to 240,184. In Birmingham, Derby, Northampton, Stourbridge and Brierley Hill, West Bromwich and Worcester, there were slight decreases, but in several other districts, including Nottingham, Stoke-on-Trent, Leicester, Walsall and Wednesbury, there were increases.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Contraction in Overseas Markets for Textile Plant.

AFTER making full allowance for the fact that the Easter holidays had a detrimental effect on trade in April, last month's shipments of textile machinery to overseas markets were the lowest for some considerable time, the total value amounting only to £694,500, compared with £775,800 in the previous month, and £971,000 in April of last year. The exports during the month under review included 5481 tons of spinning and twisting machinery, valued at £537,280, and 1220 tons of weaving machinery valued at £106,150. Under the circumstances, it is not surprising that there has been a marked falling off in shipments in pretty well every direction, compared with a year ago, Russia, France, and China being the exceptions. British India still heads the list of markets, but, at £163,000, shipments thence last month were not much more than half what they were in the corresponding period of 1929. Russia is a poor second with £99,528, followed by France with £90,922, China £58,575, the Netherlands £24,039, the United States £23,685, Japan £23,425, Germany £23,135, Australia £17,251, and South America £15,602, the aggregate shipments to "other European countries" reaching only £130,700, compared with £213,000 a year ago.

£2,200,000 for Dock Developments.

Mersey port amenities on both the Lancashire and Cheshire sides of the river will be greatly improved by the development schemes which the Docks and Harbour Board has decided to put in hand immediately. The schemes were first discussed some time ago, but certain points of difficulty arose, and it is only now that the terms of the financial assistance from the Unemployment Grants Committee have been definitely laid down. These the Docks and Harbour Board has decided to accept, and, as stated, the work is to be started at once. The first part provides for the substitution of five rolling lift bridges for four existing bridges at Birkenhead, and one at Liverpool, and towards the cost of this £295,000 is to be contributed by the Unemployment Grants Committee. The second part embraces the construction of wing walls to the Wallasey Pool Passage on the Cheshire side and also a dock extension of the existing West Float, the grant in this case amounting to £925,000. The largest grant, one of £973,486, is in connection with a third programme of work, which includes the reconstruction of the Clarence half-tide dock.

Shipments of Machinery to Russia.

The monthly traffic report of the Manchester Ship Canal Company, just issued, states that the new trade agreement with Russia has already resulted in the booking of outward freight space for machinery consignments from Manchester during the present month. This, it is pointed out, will be the first export of machinery from Manchester to Russia for some time.

Industrial Results.

Much improved results would appear to be indicated by the announcement of the directors of the Chloride Electrical Storage Company, Ltd., Manchester, that it has been decided, for the twelve months to the end of March, to pay a final tax-free dividend on the ordinary shares of 20 per cent., making a total for the year of 30 per cent., and also to distribute bonus shares in the proportion of one new share for each old one. This compares with a dividend of 10 per cent. and a bonus distribution of 15 per cent. in each of the two preceding years. Richard Johnson and Nephew, Ltd., wire manufacturers, Manchester, made a net profit for the year ended March 31st of £40,673, compared with a profit of £37,056 in the period from May 24th, 1928, to March 31st, 1929. After providing for directors' fees and depreciation, the accounts of Brooks and Doxey (1920), Ltd., textile machinery makers, Manchester, disclose a net loss of £16,943 against a net profit of £4307 in the previous year, and a net loss of £17,959 in the year 1927–28. Before provision is made for directors' remuneration and depreciation, there is a trading profit for the past year of £2956, compared with one of £24,307 in 1928–29 and of £4040 in 1927–28.

Non-ferrous Metals.

The see-saw of price movements in the market for non-ferrous metals continues in bewildering fashion. After the general recovery of the previous week there has been an all-round fall, although, with the sole exception of tin, none of the metals has descended to the depths current a fortnight ago. Copper has been the subject of a relatively heavy demand, most of it, however, of a speculative character, but the "bulls" have not had things all their own way. Unfavourable statistical advices from America had an adverse influence and standard brands of the metal are roughly £4 a ton cheaper on balance than they were a week ago. Tin has more than lost its gains of the previous week and not for long does it seem to be able to overcome the serious handicap of the heavy stocks of the metal held in this country. A decline of more than £8 a ton has brought prices below the previous "low" of a fortnight ago. Lead has attracted a fair amount of attention, but in sympathy with other sections of the market, values have lost ground on balance to the extent of about 15s. a ton. Spelter has displayed renewed weakness, and a serious decline in prices has to be reported.

Iron and Steel.

Lancashire users' interest in pig iron has been restricted and buying on hand-to-mouth lines is the order of the day, foundry trade conditions, locally, being too unsatisfactory to permit of commitments any distance ahead. There is, moreover, the price factor to be taken into account, and buyers are not without hope that lower rates for Midland brands will operate before long. Meanwhile, Staffordshire and Derbyshire No. 3 are both quoted at 77s. per ton, Scottish at about 95s., and hematite at 91s., all delivered equal to Manchester. Bar iron is decidedly slow, and prices have now eased to £10 5s. per ton for Lancashire Crown quality and about £8 15s. for seconds. There has been no improvement among constructional engineers to warrant any increased demand for steel, and transactions this week have been small. In some instances locomotive builders are taking fair quantites, but it is not general, and in almost all other respects the market for British steel is quiet, with, however, no quotable change in price levels. Here and there an expansion in the demand for foreign billets has been experienced during the past week.

BARROW-IN-FURNESS.

Hematite.

There is very little fresh to report about the West Coast hematite pig iron trade, which has recently felt the pinch of competition, and in its endeavour to keep business up to recent standard has cut prices slightly. This cutting of prices is painful, for it takes what little margin there was, practically speaking. Still, buyers are a little shy at placing orders for forward delivery, and many are content to order for immediate requirements only. There are some orders still held which will take a few months to complete, but fresh orders covering future requirements are not as plentiful as they were. Business in special qualities is maintained, and the Continent continues to be a customer for iron of low phosphorus character. America is still a customer. Iron ore is about the same, with no prospect of improvement and with the fear of a fall in demand, should the output of iron be restricted later. The steel market is moderate. Workington and Barrow are engaged on railway material, and it is understood that Barrow will share in the South African order for over 40,000 tons of rails, fish plates, &c. Probably about 10,000 tons or so will be turned out there.

Shipbuilding.

The L.M.S. steamer "Curraghmore," which came to Barrow some time ago, has been reconditioned, subjected to extensive alterations, and renamed the "Duke of Abercorn." This suggests that she is intended for the Heysham–Belfast service. The "Lady of Mann" is rapidly nearing completion for the Isle of Man Steam Packet Company. The fleet of cross-Channel steamers belonging to this company which have wintered at Barrow are now undergoing their usual overhaul, and will soon be leaving to take up their respective stations. Vickers-Armstrongs will launch from their yard on Wednesday, June 11th, three submarines for the British Admiralty.

SHEFFIELD.

(From our own Correspondent.)

Reduced Steel Production.

THE figures of steel production in Great Britain during April have now been published, and, while they are general, and do not give the details for this district, there is only too much reason to believe that the Sheffield area has suffered in common with the rest of the country. The country's total output of steel ingots and castings during April was only 696,100 tons, as compared with 826,100 tons in March, and 808,600 tons in April last year. The National Federation of Iron and Steel Manufacturers points out that, although part of the decline is due to the Easter holidays, the figures reflect a definite downward tendency. That tendency is certainly viaible in this district. The shrinkage of work, which has been reported for several weeks, has become more pronounced, and production is being curtailed at several of the open-hearth

plants. At the Templeborough works of the United Steel Companies, two large furnaces have been put out of commission, and the number running now is only five out of a total of fourteen. Several small orders are coming forward, but bulk contracts are very scarce, and the general run of the inquiries is not such as to suggest any early improvement. A similar report with regard to the outlook comes from North Lincolnshire, although in that district the works are still fairly busy with orders already on hand.

Round the Departments.

Some people have expressed the opinion that there are signs of a change for the better, but they are in the minority, and are not supported by the steel firms as a whole. On the heavy manufacturing side, the railway departments are still short of work, especially on export account. The requirements of the home railway companies are rather better than those of last year, but are still on only a moderate scale. Hacksaws, twist drills, and cold-wrought steel are among the busiest departments, and substantial business is being done in them. The stainless steel trade, although fairly well employed, is not at all as busy as it has been accustomed to be during the last two or three years. For best tool steels and alloy steels demand is below the average, although the depression in this branch is less severe than in others. On all sides of the trade, the shortage of orders is most pronounced in the export demand. All the overseas markets have considerably reduced their purchases from this country and, so far as India, Australia and China are concerned, it is doubtful whether trade has ever been as bad as it is to-day. The dulness of trade has not brought about any changes in the prices of iron and steel material. It is not considered that, at this juncture, reductions would have any effect in stimulating buying.

An Italian Steel Furnace.

At the Normanby Park Works of John Lysaght, Ltd., Scunthorpe, Lincolnshire, an Italian steel furnace is being erected, similar to one at the steel works of the Consett Iron Company, Ltd., which was brought into operation on the 1st inst. Several of Messrs. Lysaght's operators have been in Italy, studying the working of furnaces of this character. In the case of the Consett furnace, one of the principal features is that, save for the pointing of the bricks, it will work from 42 to 47 weeks without big repairs. It is so constructed as to permit no waste of gas whatever, and it will mean quicker and increased production, estimated at 1000 tons per week.

The First Egyptian Steel Foundry.

The establishment of Egypt's first steel foundry is now in progress and this district is greatly interested in the venture. Beecroft and Partners, Ltd., of Retort Works, Mappin-street, Sheffield, have contracted to supply the whole of the equipment and materials. The plant includes a steel-melting furnace, manufactured by British Furnaces, Ltd., Chesterfield, and a cupola and ladles by the Constructional Engineering Company, Birmingham. Pig iron has been supplied by the Goldendale Iron Company and the Millom and Askham Hematite Company. The output capacity of the foundry will be 30 tons of castings per week. Mr. G. C. Castle, managing director of Beecroft and Partners, and Mr. Beecroft, a director, are going out to Egypt to superintend the erection of the plant and the production of castings from the furnace.

Cast Iron Pipes.

There is good employment at the Derbyshire cast iron foundries and good prospects. The Staveley Coal and Iron Company has recently booked a number of new orders, including 770 tons of 30in. pipes for the Salford Gas Department; 650 tons of 10in., 12in. and 36in. for Leicester; 320 tons of 6in. for Birmingham, and 253 tons of 18in. for Harrogate.

Modern File Making.

I have had an opportunity of inspecting the file department of Edgar Allen and Co., Ltd., Tinsley, Sheffield, which has just been thoroughly reconstructed and modernised at a cost of some thousands of pounds. I found that the workshops have been greatly improved in the matters of light, convenience and cleanliness, while the plant has been overhauled and several interesting new machines installed. Among the latter are machines of an entirely new type for cutting file teeth, and a revolving brush for cleaning files, such as, I was informed, had never been used in Sheffield before. Another new machine is one for the "stripping," or fine grinding, of file blanks on which a smooth or dead smooth cut has to be put. This machine deals with five blanks at a time, and does, more quickly and more accurately, work that was formerly done by hand. For annealing, a new stove has been installed, while for softening the tangs the old practice of dipping in a lead bath has been superseded by a radiant heat bath, which is the first of its type that has been made. It treats a considerable number of tangs at one time, and only uses about one-third of the volume of gas that the old method did. The average output of the department recently has been 22,000 dozens of the Sheffield standard heavyweight file, and 2000 dozens of the American pattern per annum. There is now capacity for the production of 50 per cent. more than these figures. The firm has also reconstructed its circular saw department on similar lines.

New Heat-resisting Steel.

Hadfields Ltd., of Sheffield, has recently registered an advance in the production of heat-resisting steels. Hitherto, the practical limit of temperature for the continuous use of these special steels has been about 1100 deg. Cent., which, although in itself a remarkably high temperature at which to expect steel to remain exposed without serious wastage due to oxidation, left room for further improvement if the demands of industrial progress are to be fully met. With the new alloy, working temperatures higher than this are possible. Coupled with the high resistance to oxidation which the new alloy possesses, is also a remarkably high electrical resistance, some fourteen times that of pure iron, and that in itself is of special value in the construction of electric furnaces.

At Hull and Goole.

The L.N.E.R. is reconstructing the buildings on No. 2 Fish Quay at the St. Andrew's Dock Extension, Hull. It is understood that the company also intends to widen No. 1 Quay from 60ft. to 90ft., which will involve the removal and replacement on another site of several buildings. Goole Urban District Council is anxious to eiliminate the railway level crossing in Boothferry-road, the main street of the town. Sir Owen Williams has been consulted and has prepared a scheme which the Urban Council has submitted to the railway company. The scheme proposes a diversion of Boothferry-road so as to proceed over the site of houses on the south-east side of Montagu-street, thence over the railway by a bridge having a 40ft. carriageway and two 10ft. footpaths, afterwards descending into Bridge-street and, by a wide curve, returning to the Boothferry-road.

NORTH OF ENGLAND.

(From our own Correspondent.)

Iron and Steel Trade Depression.

THE iron and steel trade in the North of England appears to have definitely entered upon another period of depression. In fact, it is long since prospects were so unsatisfactory and discouraging. Not only does new business mature slowly, but the terms obtainable yield little or no profit. Customers' marked disinclination to negotiate is causing grave concern, as orders are urgently needed to follow on fast-expiring contracts. In some departments producers still have a fair amount of work to execute, but in other branches plant is being shut down owing to lack of orders, and unless unexpected expansion of demand occurs in the very near future, much machinery will have to be laid idle. Of the ninety-three blast-furnaces on the North-East Coast, only thirty-four are now in blast. Recent changes leave eight on the manufacture of Cleveland pig iron, twelve on hematite, and fourteen on other kinds of iron. In normal pre-war days the number of furnaces in operation varied from sixty-five to seventy. Output capacity of the modern furnace is vastly larger than that of the type of furnace in use before 1914, but the plant now running is producing far short of what should be required. There are rumours that more furnaces are to be damped down.

Big Order for Tees Shipyard.

Nine new whalers have been ordered by a Norwegian firm from Smith's Dock Company, Ltd., Middlesbrough. All the vessels are to be delivered by June 15th, 1931. The order will give a big impetus to the shipbuilding industry on Teesside. During the past few months orders for new tonnage have been very scarce, and as contracts were being rapidly completed, it was feared that a large number of shipyard operatives would be thrown out of employment. Many men threatened with unemployment will now, however, be assured of work for several months. The steel trade of the district will also benefit. On the other hand, there is the depressing spectacle of another yard being closed down. Sir William Gray and Co., Ltd., of West Hartlepool, are now feeling the scarcity of inquiries for new tonnage. By good organisation and enterprise they have been able to secure sufficient orders to keep both their West Hartlepool and Wear yards employed during the depression of the last year, but now lack of orders has compelled them to come to the conclusion to close their Wear yard.

Cleveland Iron Trade.

The Cleveland iron market is in a depressed condition. Although production has undergone drastic curtailment, it is still probably in excess of requirements, and further stoppages are by no means a remote possibility. Orders are nearly all for small tonnages, and lack of forward contracts obscures the outlook. Moreover, in Scotland, Indian pig iron is still being extensively used. Consumers continue to seek price concessions, but producers protest that conditions prohibit any movement in that direction. No. 1 Cleveland foundry iron is 70s.; No. 3 G.M.B., 67s. 6d.; No. 4 foundry, 66s. 6d.; and No. 4 forge, 66s.

Hematite Pig Iron.

East Coast hematite pig iron is abundant. Foreign iron is still being sold to continental firms at much below rates named for the products of this district, though quotations for East Coast brands are several shillings below cost. Ordinary qualities of local hematite are on sale at 74s., and No. 1 quality is at a premium of 6d. per ton.

Iron-making Materials.

The foreign ore trade is in a lifeless condition. Consumers have large stocks, and are delaying deliveries under running contracts. The nominal market quotation for best Rubio remains at 21s. c.i.f. Tees. Blast-furnace coke is plentiful, and very slow of sale. Local users look for a further fall in values, and are not disposed to negotiate for forward supplies. Good average qualities are offered freely at 17s. 6d. delivered to North-East Coast works, and less is understood to have been accepted.

Manufactured Iron and Steel.

Inquiries for manufactured iron and steel are still light, but for one or two descriptions of material they show just a little improvement. Works are, however, in need of better specifications for heavy steel. The sheet trade is hardly busy, but buyers are less backward than of late, and a few moderately good orders have been secured. Quotations all round are steady, but customers incline to the belief that price concessions will be granted in the near future.

The Coal Trade.

The recovery in orders in the Northern coal trade is only of a partial character, but it is sufficient to give the pits a better outlook for the next week or two. The news that the Swedish Navy has bought Polish large steam coal at 16s. per ton c.i.f. for shipment to Stockholm is rather disquieting. It is also recorded that the price for a 40,000-ton small steam coal order, which the Vesteras Power Company allocated to Poland, was 13s. 6d. per ton c.i.f. That figure, as is that for the Swedish Navy order, is extremely low, and considerably below the tenders of Northern merchants. This successful competition is causing a certain measure of apprehension in this district, in view of the substantial amount of tendering which is pending. Northumberland collieries are getting through their output very comfortably, bunker fuel for the Baltic-bound ships having augmented the usual demand. A steady feeling continues in the steam coal section, and late values are well upheld. The basis for large qualities is 13s. 6d., and for smalls 10s. to 10s. 6d. Tyne prime and similar coals are quiet and nominal at 12s. 9d. For Northumberland smalls the special grade is quoted at 11s. 3d., and good ordinary at 10s. 6d. There is a quiet position for gas coal, but no worse than fitters expected at this time of the year. Prices, however, remain unchanged. Best qualities are quoted at 15s. 9d., and seconds at 13s. 6d. to 13s. 9d. There is a steady demand for first-class bunker coal, mainly from vessels leaving in ballast for the White Sea and Russian Baltic ports. Prices are steadily held at 14s. 9d. For good ordinary class there is an ample supply at 13s. 6d. The coke trade is about stationary. There is plenty of demand from the Scandinavian importers, but the consumers will not pay the prices asked for patent oven cokes. From other importing centres there is a moderate trade passing at 18s. for good brands. Gas coke remains scarce, and any lots offered are snapped up at 21s. 6d.

SCOTLAND.

(From our own Correspondent.)

Stagnant Markets.

So far as the steel, iron and coal markets are concerned, the past week has brought no relief from the stagnation which has characterised proceedings for a considerable time past. A state of depression exists practically throughout these trades, and so far as can be ascertained there is not a sign of improvement.

Steel.

The general demand for steel does not come up to expectations, and in the majority of cases the mills are not by any means fully occupied. Orders for shipbuilding materials are especially disappointing, and lack of business in this direction accounts in no small degree for the curtailed output of plates and sections. Export orders, too, do not come up to expectation by any means, and the general outlook is still far from promising. Quotations are unchanged.

Sheets.

The turnover in sheets has fallen off somewhat. Light black sheets are still better off than the heavy varieties, but the total amount of business is not encouraging. Heavy sheets suffer in competition with the product of local plate makers. Galvanised sheets have only a moderate demand, export requirements being disappointing.

Tubes.

The demand for tubes is very uneven. Lap welded and butt welded tubes of small diameter are rather neglected at present, and the production is far below capacity. Makers of large pipes, on the other hand, are well supplied with orders.

Iron.

The bar iron and re-rolled steel departments continue quiet, and the present state of the inquiry does not denote any change for the better. Quotations for the former are unaltered at £10 5s. home and £9 15s. per ton export, and the latter remains at £7 12s. 6d. per ton home and export.

Pig Iron.

The number of furnaces in blast in Scotland at present does not exceed twenty-seven, but the production is sufficient to meet all demands. Considerable quantities continue to arrive in this district from India, the Continent, and occasionally from England. Local prices are unchanged at the agreed minimum rates of 81s., hematite 80s. 6d. No. 1 foundry, and 78s. per ton No. 3 foundry.

Scrap.

The demand for scrap has dropped considerably, and the market shows further weakness. Cast iron machinery is quoted about 67s. 6d., heavy steel 60s., and heavy basic 59s. to 60s. per ton.

Coal.

The position of the coal trade in Scotland has not improved during the past week. The collieries in the West of Scotland have dropped a fair volume of business with the advance of the season, and outputs have been curtailed, either by short time working or by the closing of pits. Not only is the home demand unfavourable, but export requirements, too, are most disappointing. Exporters meet considerable competition, especially from Poland, and only manage to secure a minimum amount of prompt orders and little or nothing in the way of forward contracts. Collieries in the Lothians and Fifeshire are especially hard hit by the lack of new export business. Generally speaking, all descriptions of fuel require orders. Prices as a rule are easier, quotations for nuts being only

maintained owing to shorter supplies. Aggregate shipments amounted to 262,388 tons, against 254,043 tons in the preceding week, and 268,205 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade.

It is extremely difficult to preserve an optimistic frame of mind regarding the coal trade, more especially the steam coal section, in face of the conditions prevailing and the lack of any sign of an expansion in the near future. The foreign demand appears to be stagnant, and very few collieries are adding to their existing commitments. They are for the most part simply relying upon their contracts for an outlet for their production. In the circumstances, it is scarcely necessary to point out that the number of colliery stoppages is excessively high. During the past week thousands of miners have been on short time, and if further explanation is needed as to why that state of affairs cannot be avoided, one has only to turn to the daily list of tipping appliances. Last week the number of appliances which were idle ranged from 28 to about 48 at all the leading South Wales ports, and at one time there were only 28 steamers loading at the three ports of Cardiff, Penarth and Barry. This week the position is not a great deal better, and on Tuesday the number of idle tips at the six leading ports in this district was still as high as 28, with no great prospect of a marked improvement. The numerous stoppages which are taking place at the various collieries means, of course, that production is down practically to current demands, but it is a costly business for colliery undertakings to be working so irregularly. The steam coal market, as a market, is virtually non-existent, and in the anthracite section the conditions are not a great deal better, as is evidenced by the fact that at some pits notices have been served to terminate their contracts. At the moment there is not a single inquiry on the market for either steam or anthracite coals which calls for special comment, and although chartering operations have been a shade more active during the past week it has not been on a scale sufficiently heavy to have marked effect on the situation generally.

Competition.

Sir Alfred Cope, the managing director of the Amalgamated Anthracite Collieries, Ltd., has just returned from a visit to Canada, to which Dominion considerable quantities of Welsh anthracite coals are shipped during the summer months. In the course of an interview with a contemporary, Sir Alfred has stated that the demand for Welsh anthracite in eastern parts of Canada is increasing and the coal is very much appreciated, but he pointed out that the competition with other fuel is very severe and business becomes, of course, a question of price. In this connection he stated that he could not see any prospect of increasing upon present prices to meet the increased cost of production in South Wales as the result of shorter working hours at the pits. Although Sir Alfred did not mention specifically the quarter from which competition is being experienced, it is not at all improbable that he has in mind the menace of Russian anthracite. The Russians are sending their coals into many markets in which South Wales has had a strong footing. Their anthracite is going into Italy, France, America and Canada in increasing quantities, and the seriousness of the position cannot be overstated. The Americans are very much alive to the menace and are considering what steps can be taken to resist what is described as unfair competition on the part of the Russians. It is stated that the Russian miners are paid 17 cents as against the American miner receiving 5 dollars per day. The gravity of the position from the point of view of South Wales producers cannot be stressed too much, when it is borne in mind that Russian anthracite has recently been imported into France, the discharging port concerned being Rouen. Russian anthracite has to be sent by rail about 500 miles to Mariupol and then carried by steamers to Rouen, the sea passage taking about 30 days, whereas in the case of South Wales the coalfield is practically at the back of the ports of shipment, viz., Swansea and Port Talbot, the rail run being 20 to 40 miles, while the sea passage to Rouen is a matter of a couple of days. Yet Russia is finding a market for its coals. It might well be asked how it can be done.

Coal Shipment Hours.

Early last week a ballot took place of the trimmers and tippers at South Wales ports on the question of an alteration in the working hours at the docks, and later there was a conference at Cardiff, when a report was presented on the result. This showed that there was a large majority of the workmen in favour of a reversion to the system of two continuous shifts, thus abolishing the present system of split shifts involving night work. A resolution was passed calling upon the executives of the respective unions to give immediate effect to the desires of the men. According to one of the men's leaders this means that immediate notice would be given to the employers to change the existing system, but so far the employing interests have not received any notification from the workmen's unions. Doubtless, what is being done is that the local unions are in consultation with their national executives, and the probability is that in the event of the national leaders failing to arrive at agreement on the matter with the employers they will ask for an independent inquiry into the dispute.

Shipping.

The state of the shipping industry continues to be very depressed, and the most disturbing feature is the lack of remunerative homeward business. Grain rates home are at lower levels than ever, and the position for owners is a very serous one. Outward coal rates are slightly better, but the improvement which has taken place does not by any means afford much compensation for the appalling state of homeward business. A number of steamers, including about a score of Cardiff-owned vessels, have during the past week or so gone on time charter to the Russian Soviet Government for periods of five or six months and will be utilised mainly in the carrying of timber. The rates of hire are stated to be slightly less than was the case this time last year, but still are better than can be obtained on open market employment. It is understood that the Soviet Government has altogether taken on time charter about 160 to 170 steamers, varying from about 2000 to 6000 tons deadweight. The fact that these steamers are off the market should influence favourably the rates which other owners can obtain, though much improvement cannot be expected with so much tonnage on the unemployed list.

Threatened Strike.

The district delegates to the council of the Rhondda No. 1 district of the South Wales Miners' Federation are alarmed about the extent of non-unionism in their area. It is stated that out of 30,000 miners only 10,000 are to-day paying their contributions. A strong campaign against the non-unionist is being organised and if it ends in failure it has been decided to start a non-unionist strike before the end of July.

Contract.

The Penarth Concrete Company, of Lower Penarth and Malvern, is reported to have secured an order from the Great Western Railway Company for the supply of 25,000 concrete posts.

Current Business.

New business continues to be on a very meagre scale and the tone of the steam coal market is quiet all round. Prices in all departments are at a minimum. Large coals of all descriptions are freely offered, and standing stocks are heavy. Smalls are about steady on account of the diminished production of these qualities. The inquiry for patent fuel remains without improvement, while pitwood is a slow market with prices about 25s. to 25s. 3d.

The Institution of Civil Engineers.

APRIL EXAMINATIONS, 1930: PASS LIST (*INTERIM*).

PRELIMINARY (106).

B. C. Adams, J. F. B. Allbut, G. A. H. Ball, H. A. Ballantyne, L. H. Bartlett, H. J. Bedford, J. B. Bennett, E. A. Bessant, J. P. Bett, G. H. Binnie, N. Borg, H. Bowdler, J. Broadbent, R. Bruce, J. C. Calvert, S. K. Campbell, A. K. Caris, R. W. S. Casebourne, G. H. C. Cooper, J. F. Cooper, W. E. Cooper, F. J. Crowther, D. N. Davidson, J. M. Doherty, G. W. Dunnett, D. Exley, G. Fraser, E. B. Frewen, L. M. Gardiner, H. Gayton, F. E. Gibbs, S. W. Godfrey, R. W. Grant, J. N. Griffiths, K. A. Harrison, C. F. Hebburn, W. Hill, E. C. Hodgson, E. J. N. Holder, C. R. H. Howard, N. Hoyle, F. G. E. Ievers, J. R. Ingram, W. W. Jackson, A. G. Jarvis, G. A. Jennings, A. Juler, J. C. Kidd, H. K. King, F. A. L. Knapp, G. H. Lambert, K. W. Lofthouse, H. M. C. Login, A. N. Marshall, J. H. Martin, W. Mitchell, J. R. Muff, C. J. Mustchin, H. B. Nicholson, F. W. Pearce, W. E. Pegg, G. E. Perks, L. Pickup, C. W. Pike, G. J. Plant, C. W. Potter, E. G. P. Powell, L. G. Pritchard, W. S. Rae, M.C., P. Ransome, F. Rath, A. L. Reeve, R. A. Reilly, L. V. Relph, J. H. Reynolds, C. Rigby, J. Rigg, J. Robinson, T. P. Roper, L. Russel, G. J. Ryder, E. B. Rydout, R. J. F. Sansome, K. M. Scott, H. F. Scrimgeour, F. T. Sesar, C. G. Sexton, A. Sinclair, J. F. Sleat, J. A. F. Smith, P. A. Smith, P. P. Soutter, W. H. Spencer, E. C. Summers, E. A. Tebbs, H. Thompson, S. MacA. Thompson, J. L. Timbers, S. W. Trueman, R. Turner, A. W. W. Wadbrook, P. S. Waddington, S. A. S. Walton, E. FitzG. Warren, W. R. Waugh, G. Williams.

ASSOCIATE MEMBERSHIP (292).

Whole Examination (Sections A, B and C) (5).—H. R. Barrett, E. L. Butt, A. L. Fielding, H. H. B. Hurd, D. M. McKellen.

Sections A and B only (31).—E. Armstrong, G. Blackwood, G. E. V. Boldry, W. R. Branson, A. Brown, G. E. E. Buchner, J. W. Caldwell, E. J. Cridlan, N. W. Crisp, A. Curry, J. Finn, S. A. Fraser, T. A. Garland, B. T. Good, F. J. Grevatt, A. E. C. de S. Gunasekera, J. D. Knowles, J. MacKenzie, H. Martin, F. M. P. Maurice, J. Mitchell, A. M. Rankin, J. J. V. Rogers, H. G. Royds, J. Semple, J. Shepherd, A. H. T. Shields, R. C. Smith, G. W. Spencer, L. J. A. Stow, F. D. Taylor.

Sections A and C only (4).—S. Green, R. Lloyd, C. T. Read, E. M. Richardson.

Sections B and C only (22).—R. A. H. Allen, E. Bateson, J. E. Belbin, R. Carey, R. Cornish, J. W. Dunn, A. S. Fairn, A. J. Felstead, W. H. Gamble, T. H. Higson, D. Y. Hill, R. A. Japp, P. Macfarlane, R. L. McIlmoyle, J. M. McLeod, D. McVean, J. Miller, H. Millican, W. Morris, P. M. Spencer, A. N. Sutherland, G. G. Watson.

Section A only (62).—W. M. Anderson, H. W. Barkas, E. M. Barnard, J. Barratt, G. C. B. Begg, F. D. Blaker, J. R. Bottomley, C. H. Brown, W. Brown, T. D. Burdis, C. V. Burn, J. C. O. Burns, F. H. Clough, H. C. H. Crawley, H. F. Daniel, D. G. Davies, C. E. Day, A. Frew, W. W. Garner, S. A. Green, A. E. Greig, L. J. Grimshaw, O. Hails, T. G. Hand, K. E. Higham, G. A. Hill, G. E. Hill, R. Hilton, B. Holroyde, W. L. Houlbrook, M. M. H. Inglis, J. D. W. Jeffery, L. E. Kent, K. E. Langford, M. C. Leney, A. J. Loveland, J. F. S. MacDonald, M. MacM. Mackenzie, G. N. Maynard, R. G. Murdoch, C. G. Reddington, K. P. Rush, J. C. Russell, J. E. Sargent, T. D. Sellman, A. D. L. Shea, J. G. Smith, J. F. G. Spring, B. S. Summers, A. Sutherland, W. S. Tait, J. Taylor, W. A. Turner, W. H. Vickers, E. Walker, I. G. Watson, W. F. White, N. P. Winks, G. E. Woodhead, J. A. Young, W. Young, W. Young.

Section B only (51).—W. B. Acton, jun., J. W. R. Adshead, R. F. Alexander, A. L. Archibald, T. L. Bowring, H. R. Bridger, A. Burrows, D. M. Cannon, R. D. Chalcraft, H. G. W. Cook, J. V. Cook, H. R. Davenport, I. L. D. Davies, G. M. Dingwall, A. C. U. Forrest, W. Grant, J. A. Harper, C. C. B. Herbert, W. G. King, D. P. Kinsey-Miles, D. H. Lawson, W. F. Longfield, K. B. Manning, F. Margerison, W. K. Marples, R. Marshall, C. Needham, A. W. Nettleton, D. T. Owen, M. J. Page, A. J. P. Pashler, L. W. Roberts, J. S. Robson, S. J. D. Russell, W. H. Sebley, J. D. Sharman, J. D. Sheasby, F. Smith, W. McC. Smith, C. H. S. Spaull, S. P. Squire, G. S. Standley, J. D. S. Stephen, N. H. Stockley, J. A. Thomson, W. Tivendale, D. M. Waite, H. D. Watt, J. B. White, C. V. Williams, D. J. MacG. Williamson.

Section C only (117).—J. Anderson, F. Anderton, H. C. H. Armstead, B.Sc. Eng. (Lond.), F. Bardsley, N. C. C. Barrell, E. Beckett, B.Eng. (Liverpool), B. L. Bell, B.Sc. Eng. (Lond.), E. S. Benson, P. R. S. Berridge, B.Sc. Eng. (Lond.), W. Booth, N. B. Bourne, B.A. (Cantab.), E. E. Box, E. C. Boyce, B.Sc. Eng. (Lond.), J. H. Brass, H. F. Bull, G. Butters, H. G. Buxton, J. Clough, B.Sc. (Manchester), G. S. Collie, A. J. Collins, B.Sc. (Bristol), P. G. Corder, K. F. Corfield, B.Sc. (Birmingham), A. Cowie, E. T. Crowe, B.Sc. Eng. (Lond.), T. V. Cuerden, B.A. (Cantab.), L. G. Culshaw, C. C. Cunnold, M. N. Dalal, R. W. Daniel, B.Sc. Eng. (Lond.), E. F. H. D'Ath, M. R. V. Davies, B.Sc. (Birmingham), J. R. Daymond, B.Sc (Wales), W. Dempster, W. A. Dow, B.Sc. Eng. (Lond.), T. V. S. Durrant, B.A. (Cantab.), G. C. N. Elliot, N. R. Elliott, H. J. Escreet, B.Sc. Eng. (Lond.), H. B. Everard, B.A. (Cantab.), H. Fisher, B.Sc. Eng. (Lond.), H. L. Folkes, C. E. Foster, B.Sc. Eng. (Lond.), A. W. Gemmell, B.Sc. Eng. (Lond.), L. V. Gordon, B.Sc. Eng. (Lond.), J. W. Greenhalgh, B.A. (Cantab.), G. S. A. Gundry, B.Sc. (Glas.), T. D. Hackney, R. T. Hamilton, H. C. Hampton, R. S. Hay, B.A.I. (Dublin), G. I. Heddle, B.Sc. (Glas.), L. F. Hobbs, B.Sc. (Bristol), E. L. Horn, H. I. Hughes, B.Eng. (Sheffield), J. W. Hurst, B.Sc. Eng. (Lond.), J. H. Jellett, B.A. (Cantab.), F. W. Jones, O. A. Kerensky, B.Sc. Eng. (Lond.), A. Koffman, B.Sc. Eng. (Lond.), W. Linn, E. A. Logan, B.Sc. (Durham), A. S. Lowe, M.C., A. L. McClure, B.Sc. Eng. (Lond.), F. R. MacRae, A. N. Marchant, B.Sc. (Bristol), K. D. Mathewson, B.A. (Cantab.), H. S. B. Meakin, B.Sc. (Durham), R. H. Millar, B.Sc. Eng. (Lond.), J. T. Moore, B.Sc. (Glas.), T. W. Moran, B.A.I. (Dublin), V. A. Morgan, B.Eng. (Liverpool), M. Morrison, B.Sc. (Glas.), E. J. B. Mulligan, B.Sc. (Edin.), A. Nathan, B.Sc. Eng. (Lond.), H. L. Newton, B.Sc. Eng. (Lond.), R. E. O'Malley, B.Sc. (Durham), P. R. Paxton, B.Eng. (Liverpool), J. H. A. Perkins, P. J. Pollock, B.A. (Cantab.), E. C. Pound, B.Sc. Eng. (Lond.), R. A. Powell, B.Sc. Eng. (Lond.), V. C. F. Price, B.Sc. Eng. (Lond.), R. P. Radcliffe, R. S. Rendle, E. Roberts, R. G. S. Roberts, T. H. Rogers, B.Sc. (Wales), A. E. Sadler, B.Sc. (Birmingham), C. D. Shann, B.A. (Cantab.), W. D. Short, B.Sc. (Glas.), J. H. Siddons, B.Eng. (Sheffield), C. Simpson, A. B. O'N. Skinner, B.Sc. (Edin.), F. W. Slade, C. H. Smith, J. G. Smith, L. M. Smith, B.Sc. (Edin.), F. N. Sparkes, B.Sc. (Bristol), G. T. Starling, G. R. S. Stow, B.Sc. Eng. (Lond.), W. E. Tait, B.Sc. (Birmingham), J. O. Taudevin, R. H. Taylor, B.Sc. (Manchester), G. F. Urquhart, B.Sc. (Glas.), F. Waite, T. G. Wakley, B.Sc. Eng. (Lond.), W. MacK. Walker, R. C. Warren, B.Sc. (Glas.), W. G. Wheatley, B.Eng. (Liverpool), T. E. S. White, B.Sc. Eng. (Lond.), L. E. Williams, G. L. Wilson, B.Eng. (Liverpool), T. F. R. Wilson, F. T. Wood, J. C. R. Woodside, G. L. Worcester, B.Sc. Eng. (Lond.), R. T. Wyllie, B.Sc. Eng. (Lond.).

CONTRACTS.

BLACKSTONE AND CO., Ltd., of Stamford, has received orders for an 8in. sand pump and steam engine from the Poole Harbour Commissioners; and for vertical spindle electrically driven unchokeable unscreened sewage pumps from the Southwell Rural District Council.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

JOSEPH ADAMSON AND CO., of Hyde, Cheshire, asks to announce that they have purchased the goodwill of Thomas Beeley and Son, Ltd., also of Hyde, including the drawings, patterns, and other records of the latter company's past work.

MAJOR W. H. C. COATES, M.C., M.I.E.E., of 8, St. James's-square, S.W., desires us to announce that he terminated on May 7th his engagement with the English Electric Company, Ltd., with which he had been connected since its formation in 1919.

WILD-BARFIELD ELECTRIC FURNACES, Ltd., asks us to announce that its licensee for France, Switzerland and the Netherlands, La Compagnie Française "Wild-Barfield," has taken new premises at 110, Avenue du Général Michel Bizot, Paris.

H. NIMMO, M.I.E.E., M.I.Mech.E., late Electrical Inspector and Adviser to the Government of Burma, has been appointed Chief Engineering Inspector of the Electricity Commission as from May 15th, 1930, in succession to Colonel T. C. Ekin, M. Inst. C.E., who has retired under the age limit.

BURTON, GRIFFITHS AND CO., Ltd., ask us to announce that they have erected new head offices, showrooms and warehouses at Montgomery-street, Sparkbrook, Birmingham. Telephone, Birmingham, Victoria, 2121–24; telegraphic address, "Hibou, Birmingham." The company's London and other addresses remain unaltered.

THE NATIONAL FEDERATION OF IRON AND STEEL MANUFACTURERS ask us to announce that at the annual general meeting of this Federation, held on May 15th, the Hon. Roland Kitson, D.S.O., M.C.—a director of Dorman, Long and Co., Ltd.—was elected President of the Federation for 1931; and Messrs. W. Simons—managing director, British (Guest Keen Baldwins) Iron and Steel Company, Ltd.—and James Henderson—a director of the United Steel Companies, Ltd.—were elected additional Vice-Presidents.

CATALOGUES.

GUMMERS, Ltd., Rotherham.—List No. 30 of "Twintite" plunger valves.

MACINLOF, Ltd., Manchester.—A comprehensive handbook on transmission belting.

COOPER ROLLER BEARINGS COMPANY, Ltd., King's Lynn.—A leaflet describing the Benn friction clutch.

INTEGRA COMPANY, Ltd., 183, Broad-street, Birmingham.—"The Homo Method Applied to Nitriding of Steel."

A. REYROLLE AND CO., Ltd., Hebburn-on-Tyne.—Pamphlet No. 521 of Feebles-Reyrolle automatic motor converter sub-station equipment.

GENERAL CHEMICAL AND PHARMACEUTICAL COMPANY, Ltd., Willesden, N.W. 10.—Catalogue of "Judex" analytical reagents and laboratory chemicals.

CHURCHILL MACHINE TOOL COMPANY, Ltd., Broadheath, near Manchester.—Pamphlet I.N. 9, containing particulars of Churchill internal grinding machines.

MONEL-WEIR, Ltd., Cathcart, Glasgow.—"Monel Metal and Malleable Nickel: A Review of Established Applications in the Chemical By-product and Process Industries."

KING'S PATENT AGENCY, Ltd., 146a, Queen Victoria-street, E.C. 4.—A booklet, "Patents and Trade Marks; including some Useful Information on Designs and Copyright," by Mr. B. T. King.

COMBUSTION STEAM GENERATOR COMPANY, Ltd., Africa House, Kingsway, W.C. 2.—A booklet giving summarised particulars of some installations, put in by the firm, to show the adaptability of the plant for different conditions.

METROPOLITAN-VICKERS ELECTRICAL COMPANY, Ltd., Trafford Park, Manchester.—A 170-page catalogue giving full details of "Met-Vick" marine accessories; also Publication 7452/1, dealing with the self-contained turbo-generating unit originated by the firm in 1927.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	19/6 to 21/–
(1) Spanish	21/6 to 23/–
N.E. COAST—	
Native	18/– to 21/–
Foreign (c.i.f.)	21/–

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	4 1 0	—
No. 1 Foundry	4 0 6	—
No. 3 Foundry	3 18 0	—
N.E. COAST—		
Hematite Mixed Nos.	3 14 0	3 14 0
No. 1	3 14 6	3 14 6
Cleveland—		
No. 1	3 10 0	3 10 0
Silicious Iron	3 10 0	3 10 0
No. 3 G.M.B.	3 7 6	3 7 6
No. 4 Foundry	3 6 6	3 6 6
No. 4 Forge	3 6 0	3 6 0
Mottled	3 5 6	3 5 6
White	3 5 6	3 5 6
MIDLANDS—		
(3) Staffs.—	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 15 6	—
„ „ Foundry	3 19 6	—
(3) Northampton—		
Foundry No. 3	3 15 0	—
Forge	3 11 0	—
(1) Derbyshire—		
No. 3 Foundry	3 18 6	—
Forge	3 14 6	—
(3) Lincolnshire—		
No. 3 Foundry	3 13 6	—
No. 4 Forge	3 9 6	—
Basic	—	—
(4) N.W. COAST—		
N. Lancs and Cum.—		
Hematite Mixed Nos.	4 8 6 (*a*) 4 10 6 (*b*) 4 14 0 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 10 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Double Best Bars	11 15 0	—
Treble Best Bars	12 5 0	—
LANCS.—		
Crown Bars	10 5 0	—
Second Quality Bars	8 15 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	11 0 0	—
Best Bars	11 10 0	—
Hoops	12 0 0	—
MIDLANDS—		
Crown Bars	10 0 0 to 10 7 6	—
Marked Bars (Staffs.)	12 10 0	—
Nut and Bolt Bars	9 0 0 to 9 7 6	—
Gas Tube Strip	11 2 6	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates (Marine)	10 10 0	10 10 0
„ „ (Land)	10 0 0	10 0 0
Ship Plates, ¾in. and up	8 15 0	7 15 0
Sections	8 7 6	7 7 6
Steel Sheets, ¼in.	9 0 0	8 15 0
Sheets (Gal. Cor. 24 B.G.)	12 15 0	12 5 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 15 0	7 15 0
Angles	8 7 6	7 7 6
Boiler Plates (Marine)	10 10 0	—
„ „ (Land)	10 0 0	—
Joists	8 10 0	7 7 6
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 10 0	—
Light Rails	8 15 0 to 9 0 0	—
Billets	6 15 0 to 9 10 0	—
MANCHESTER—		
Bars (Round)	9 7 6	—
„ (Small Round)	8 0 0 to 8 2 6	—
Hoops (Baling)	10 0 0	9 15 0
„ (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
„ (Lancs. Boiler)	9 17 6	—
SHEFFIELD—		
Siemens Acid Billets	9 10 0 (basis)	—
Hard Basic	9 2 6 and 9 12 6	—
Intermediate Basic	7 12 6 and 8 2 6	—
Soft Basic	6 10 0	—
Hoops	9 15 0 to 10 0 0	—
Soft Wire Rods	8 0 0	—
MIDLANDS—		
Small Rolled Bars	8 0 0 to 8 15 0	—
Billets and Sheet Bars	6 0 0 to 6 12 6	—
Galv. Sheets, f.o.b. L'pool	11 17 6	—
Sheets (30 W.G.)	16 7 6	—
Angles	8 7 6	—
Joists	8 10 0	—
Tees	9 7 6	—
Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 12 6	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/3 to 18/6
Block Tin (cash)	141 15 0
„ (three months)	143 12 6
Copper (cash)	53 17 6
„ (three months)	53 15 0
Spanish Lead (cash)	17 13 9
„ „ (three months)	17 15 0
Spelter (cash)	16 7 6
„ (three months)	17 3 9
MANCHESTER—	
Copper, Best Selected Ingots	60 5 0
„ Electrolytic	61 0 0
„ Strong Sheets	92 0 0
„ Tubes (Basis Price), lb.	0 1 0½
Brass Tubes (Basis Price), lb.	0 0 11½
„ Condenser, lb.	0 1 1½
Lead, English	19 10 0
„ Foreign	18 0 0
Spelter	17 12 6
Aluminium (per ton—raw ingot)	£95

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	3/1 per lb.	
Ferro Tungsten	2/10 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 12 6	7/–
„ „ 6 p.c. to 8 p.c.	£22 10 0	7/–
„ „ 8 p.c. to 10 p.c.	£22 0 0	7/–
„ „ Specially refined		
„ „ Max. 2 p.c. carbon	£33 10 0	10/–
„ „ „ 1 p.c. carbon	£38 0 0	13/6
„ „ „ 0·70 p.c. carbon	£40 0 0	15/–
„ „ „ carbon free	11d. per lb.	
Metallic Chromium	2/7 per lb.	
Ferro Manganese (per ton)	£11 15 0 for home	
„ „ „	£11 0 0 for export	
„ Silicon, 45 p.c. to 50 p.c.	£11 10 0 scale 5/– per unit	
„ „ 75 p.c.	£19 0 0 scale 7/– per unit	
„ Vanadium	12/9 per lb.	
„ Molybdenum	4/2 per lb.	
„ Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£170 to £175	
Ferro Cobalt	9/6 per lb.	

FUELS.

SCOTLAND.

(*Prices not stable.*)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	12/6
„ „ Ell	14/–
„ „ Splint	15/– to 16/–
„ „ Trebles	12/–
„ „ Doubles	11/3
„ „ Singles	10/6
AYRSHIRE—	
(f.o.b. Ports)—Steam	13/3
„ „ Jewel	16/–
„ „ Trebles	12/–
FIFESHIRE—	
f.o.b. Methil or Burntisland—Steam	10/3 to 12/9
Screened Navigation	16/6
Trebles	12/– to 12/6
Doubles	11/–
Singles	10/9
LOTHIANS—	
(f.o.b. Leith)—Best Steam	12/3
Secondary Steam	12/–
Trebles	12/6
Doubles	11/–
Singles	10/9

ENGLAND.

(8) N.W. COAST—	
Steams	21/6 to 23/–
Household	38/– to 51/–
Coke	22/– to 22/6
NORTHUMBERLAND—	
Best Steams	13/6
Second Steams	12/–
Steam Smalls	10/– to 10/6
Unscreened	13/–
Household	25/– to 37/–
DURHAM—	
Best Gas	15/9
Second	13/3 to 13/6
Household	25/– to 37/–
Foundry Coke	26/– to 29/–
SHEFFIELD—	Inland.
Best Hand-picked Branch	25/– to 26/6 —
Derbyshire Best Bright House	20/– to 22/– —
Best House Coal	19/– to 20/– —
Screened House Coal	17/– to 19/– —
„ „ Nuts	15/– to 17/– —
Yorkshire Hards	14/6 to 16/– —
Derbyshire Hards	14/6 to 16/– —
Rough Slacks	8/6 to 9/– —
Nutty Slacks	7/– to 8/– —
Smalls	3/– to 5/– —
Blast-furnace Coke (Inland)	15/6 on rail at ovens
Furnace and Foundry Coke (Export), f.o.b. 19/6 to 20/–	

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	20/–
Second Smokeless Large	18/9 to 19/9
Best Dry Large	18/6 to 18/9
Ordinary Dry Large	17/6 to 18/–
Best Black Vein Large	18/3 to 18/6
Western Valley Large	18/– to 18/3
Best Eastern Valley Large	17/9 to 18/–
Ordinary Eastern Valley Large	17/6 to 17/9
Best Steam Smalls	13/3 to 14/–
Ordinary Smalls	12/6 to 13/–
Washed Nuts	17/– to 20/6
No. 3 Rhondda Large	20/6 to 21/–
„ „ Smalls	15/6 to 16/–
No. 2 „ Large	17/– to 17/3
„ „ Through	16/– to 16/6
„ „ Smalls	14/– to 14/3
Foundry Coke (Export)	30/– to 37/–
Furnace Coke (Export)	25/– to 27/6
Patent Fuel	22/– to 22/6
Pitwood (ex ship)	25/3 to 25/6
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	35/– to 37/6
Seconds	28/– to 32/–
Red Vein	23/6 to 27/6
Machine-made Cobbles	41/6 to 45/–
Nuts	40/– to 46/–
Beans	24/6 to 27/6
Peas	19/6 to 20/6
Breaker Duff	10/– to 10/6
Rubbly Culm	11/– to 12/–
Steam Coals:	
Large	19/6 to 20/6
Seconds	18/– to 19/6
Smalls	12/6 to 13/6
Cargo Through	15/6 to 16/–

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate: Joists (minimum), 12/6; Ordinary Ship, Bridge, and Tank Plates and Sections, 10/– if home consumers confine purchases from associated British Steel Makers.

French Engineering Notes.

(From our Correspondent in Paris.)

The Steel Cartel.

THE meeting of the Steel Cartel in Paris was unable to come to a definite decision concerning the production of steel and the constitution of permanent sales comptoirs in place of the temporary organisation which had been formed for the first six months of the year. There is obviously no necessity to impose a reduction of output when it will be effected automatically by the operation of the comptoirs, but there are serious difficulties in the way of allotting quotas of foreign trade to the different associated countries, and the Paris meeting had to postpone further discussion until a settlement has been arrived at with regard to the sale of semi-manufactured steel and girders. It is felt that something must be done to place the organisation on a satisfactory basis with the least possible delay, for the situation of the steel trade on the Continent is becoming worse every week, and in France, where the conditions are generally much more favourable, business has been steadily contracting until it is now admitted that the only hope of averting a serious crisis lies in enabling the Cartel and the comptoirs to exercise a more effective control of the trade.

Aber Wrac'h Power Station.

Little has been heard of late of the Aber Wrac'h experimental tidal power station which is to be constructed across the estuary of the Rance, near Brest. The work has been delayed by the failure of the State to contribute its share to the cost of the undertaking. The scheme was authorised by Parliament in 1923, when a concession was granted to a private company, with an undertaking that a subsidy would be paid by the State, but since then there have b en many changes, notably the reconstruction of the company on an international basis. Meanwhile, the concession had expired through failure to start work within the stipulated time, but as the State was mainly responsible for the delay the concession was renewed last year, when Parliament voted a sum of 4,000,000f. as its contribution to the cost. This money has not yet been paid, on the ground, it is said, that there was some irregularity in the terms of the law of 1923. It is hoped that this difficulty will be settled shortly so that the State can give the promised financial aid, without which the company does not intend to carry on the work. Nevertheless, preliminary operations continue to be effected, and a good deal of rock has been removed on each side of the estuary for the abutments of the dam, and a power station is being constructed with that material. The delay has also allowed of further research work in the designing of suitable turbines, and, apparently, the results obtained are so far satisfactory that they may modify the original plans and avoid the necessity of constructing an auxiliary fresh-water dam. There will be four reversible turbines, which will, it is said, maintain a constant efficiency under heads varying from 50 cm. to 10 m. It is proposed to store in compressed air tanks some of the energy produced by the turbines under full head, and that will be converted into electrical energy during the periods of high and low tides. The interest of the Aber Wrac'h scheme lies in its experimental character and will doubtless continue to undergo modifications suggested by further experiment and research.

A Non-stop Run.

The Chemins de Fer du Nord have initiated a summer service between Paris and Liége whereby the distance of 227·9 miles between the two cities is covered without a stop in exactly four hours. This is the longest non-stop run on the Continent. The train leaves Paris at 7.45 a.m. and starts on the return journey at 7.45 p.m., thus allowing eight hours in Liége. The locomotive is of the newest "Super-Pacific" type, similar to the locomotives making non-stop runs to Calais, Dunkirk and Brussels. The tender has a capacity of about 35 c.m. The train is composed of two first-class and two second-class coaches, a dining car and two vans. On the French line the distance of 148 miles is covered at an average speed of 65·8 miles an hour, but on the Belgian system such speeds are out of the question.

A New Motor Liner.

The largest motor ship in the French marine, the "La Fayette," has started on her maiden run from Havre to New York. The vessel, which has a displacement of 25,000 tons, is propelled by four Diesel engines with 60 cm. bore and 90 cm. stroke and developing altogether about 18,500 horse-power. The engines run at about 150 revolutions per minute for a speed of 18 knots. The oil fuel is stored in the double bottom of the ship and in tanks, the total capacity being 2250 c.m. The ship has ten watertight bulkheads.

Power and Flight.

More than twenty years ago Colonel Lafay, professor of physics at the Ecole Polytechnique, began to investigate the reasons why so much power is required to drive aeroplanes when so little effort is expended by birds to fly long distances. He concluded that birds possess a sense that enables them to utilise the dynamic forces of air currents, and the results obtained by manœuvring in air currents are well known and are shown by the successful flights of gliders in cases in which the direction of such currents can be judged from local topography, and then only when the currents are fairly steady. Colonel Lafay has, therefore, been investigating the ways and means of enabling pilots to ascertain the direction and force of air currents by the sense of hearing. By placing microphones in the wings and gliding from an altitude with the engine stopped it is found that variable air pressures on the planes change the note, and it is supposed that by identifying the notes with different pressures the pilot will learn almost instinctively to manœuvre the planes in order to keep to the optimum note and thereby utilise the air pressures to the best advantage. Colonel Lafay is convinced that this can be done, and that it can be best attained by experiments with gliders.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

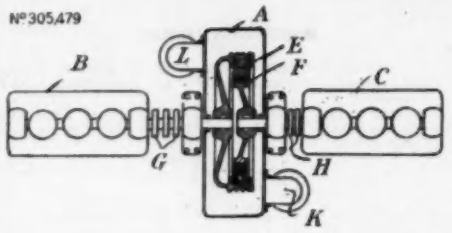
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

DYNAMOS AND MOTORS.

305,479. February 4th, 1929.—PLANT FOR GENERATING ELECTRIC CURRENT, *International General Electric Company, Incorporated, of* 120, *Broadway, New York.*

For driving the generator A two engines B and C are employed, and the two parts of the generator E and F are driven in opposite directions. The engines are usually run at comparatively low speed and undue oscillations are avoided owing to the high

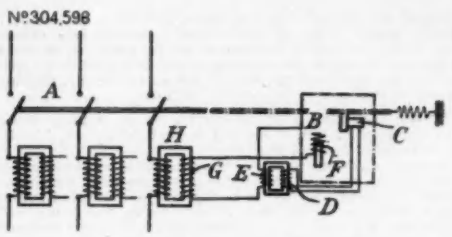


degree of smoothness of running of the induced and inducing parts. Three-cylinder engines are shown, but in most cases the number of cylinders is much greater. The slip rings G for the induced part of the generator and those H for the inducing part are situated between the bearings as shown. The generator is enclosed by a casing having inlets and outlets K and L for the supply of cool air and the withdrawal of hot air.—*April 17th*, 1930.

SWITCHGEAR.

304,598. January 19th, 1929.—AUTOMATIC ELECTRIC CUT-OUTS WITH INSTANTANEOUS AND DELAY ACTION RELEASES, Siemens-Schuckertwerke Aktiengesellschaft, of Berlin-Siemensstadt, Germany.

According to this invention, a thermal release is fed from a short circuit proof current transformer which is fed from the transmission line through a second current transformer, while the magnetic release is fed direct from the second current transformer. By this arrangement a single current transformer connected in the main transmission line can be used for feeding both the quick break and the thermal release, thus effecting considerable saving in cost. The short-circuit-proof current

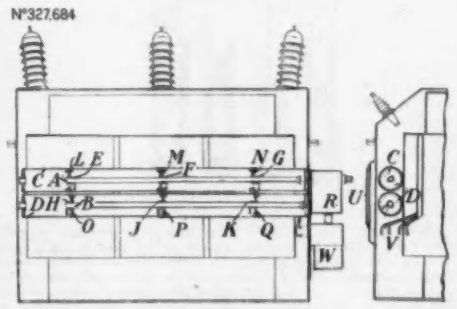


transformer is a small apparatus, the cost of which is unimportant in comparison with the cost of the complete contrivance. The switch A may be opened by the magnetic releases B which operate in a very short space of time, *i.e.*, substantially instantaneously, and by thermal releases C which operate with a delay action. These releases are shown for only one phase of a three-phase switch. The thermal release C is connected to the secondary coil D of a short-circuit-proof current transformer, the primary coil E of which is in series with the winding F of the magnetic release B and is connected to the secondary coil G of a current transformer H in one of the phases to be cut out.—*April 17th*, 1930.

TRANSFORMERS AND CONVERTERS.

327,684. January 3rd, 1929.—OIL-FILLED ELECTRIC TRANSFORMERS, Alfred William George Tucker and Ferranti, Ltd., both of Hollinwood, Lancaster.

This invention consists briefly in an oil-filled electric transformer having tapping switch arrangements horizontally disposed alongside the windings and capable of being withdrawn axially

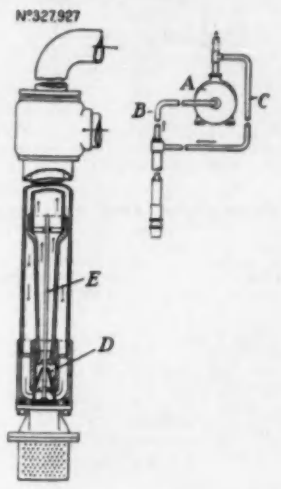


from the transformer casing. A and B show the two horizontal tap-changing spindles in the insulating tubes C and D and carrying the movable contact members E, F, G and H, J, K, which co-act with the fixed contacts in the discs of insulating material L, M, N and O, P, Q. Actuating mechanism—not shown—is provided within the box R and manipulated by a handle applied to the projecting end of the spindle. U indicates an inspection door for obtaining access, after removal of oil from the tanks, to apertures formed in the tubes C and D for the accommodation of the leads and to give access thereto, while V indicates the series connections and W the series switches.—*April 3rd*, 1930.

PUMPING AND BLOWING MACHINERY.

327,927. July 23rd, 1929.—APPARATUS FOR RAISING WATER, J. T. Wade, Fairfield Works, West Wycombe-road, High Wycombe, Bucks.

The inventor proposes to raise water from bore-holes by an ejector-like action. A turbine pump A is installed on the surface and draws water through the suction pipe B, which reaches to the bottom of the well in the centre of the bore. The discharge pipe of the pump is branched, as shown, and about half of the

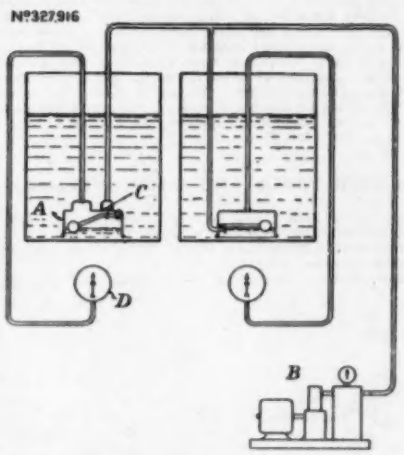


water pumped is returned to the well by the pipe C. This water flows down the annular space between the suction pipe and the casing and finds its way into the ejector D at the bottom. This water entrains other water, coming from the strum, which provides the useful output of the pump. The rod E is arranged within the axis of the ejector, as it is found that a central core of liquid greatly impairs the efficiency of the apparatus.—*April 17th*, 1930.

MEASURING AND TESTING INSTRUMENTS.

327,916. July 1st, 1929.—DEPTH GAUGES, L. Murphy, 156, Richmond-road, Dublin.

This depth gauge is of the pneumatic type. A bell A is arranged at the bottom of the tank containing the liquid to be gauged, and is supplied with air under pressure by the compressor B. The inlet of the air to the bell is controlled by the float valve C, the opening of which is dependent upon the depth of the liquid, outside the bell, in the tank. The pressure of the air

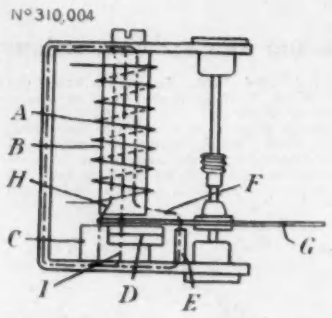


in the bell is always maintained slightly in excess of that due to the head of liquid in the tank and any surplus bubbles up through the liquid. The pressure of the air in the bell is indicated by a gauge D, which is calibrated and divided to read in units of depth of liquid. In the tank on the right in the illustration an alternative arrangement of float valve is indicated.—*April 17th*, 1930.

310,004. April 16th, 1929.—TEMPERATURE COMPENSATION DEVICES FOR ELECTRIC MEASURING INSTRUMENTS, *International General Electric Company, Incorporated, of* 120, *Broadway, New York.*

This invention relates to electric measuring instruments of the Ferraris motor type, in which the magnetic flux generated by the voltage winding is in part loaded by a short-circuit ring. The flux is divided into two parts, which co-operate and produce a braking torque on the disc as well as a driving torque, and the speed at which the disc rotates depends upon the resultant of these two forces. In such instruments any variation in the temperature produces a variation in the speed of rotation of the disc owing to the alterations in the magnetic properties of the iron and in the conductivity of the material of the winding and of the disc. According to the invention, means are provided for producing a stray flux through the disc in addition to the main and dephased voltage driving fluxes, the magnetic path of this stray flux including a material with a magnetic temperature coefficient equal to the magnetic temperature coefficient which the instrument would possess without the provision of the stray flux. In the drawing A indicates the voltage winding with a core B, G the rotating disc and C the counterpole having a short-circuited winding D embracing part of it. The stray flux is led off through a magnetic path E and H represents the unloaded part of the flux penetrating the disc, whilst I represents the loaded part. The magnetic return takes place through the frame

of the instrument. The part E for the stray flux F may be made of any magnetic material having a magnetic temperature coefficient similar to that of the uncompensated instrument,

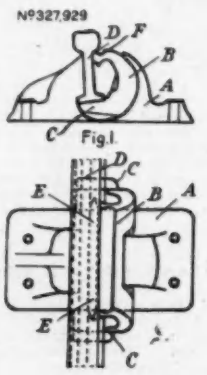


and a suitable material is a cast alloy composed of 68 per cent. Ni, 30 per cent. Cu and 2 per cent. Fe, quenched in water as solidification occurs.—*April 17th*, 1930.

TRAMWAYS AND RAILWAYS.

327,929. July 25th, 1929.—RAILWAY RAIL CHAIRS, E. T. Borlase, Greenside Lodge, Glenridding, near Penrith, and H. Oglethorpe, Raw Head, Glenridding.

The invention consists of a specially constructed semi-circular steel jaw B, Fig. 1, bevelled at the back to fit the chair, having two lugs C, which protrude and extend underneath the rail on either side of the chair. The jaw when placed in position is slightly raised above the rail base of the chair. The jaw is so balanced in the chair that, when the rail is inserted, the weight

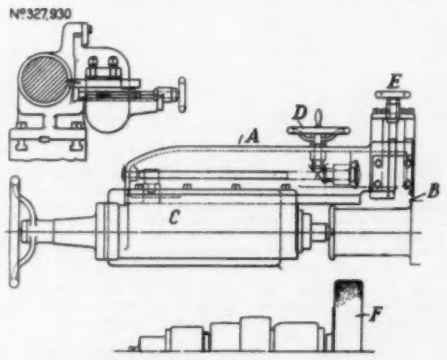


of the rail bearing down on the two lugs C causes the jaw to move radially towards the web D of the rail, gripping the rail firmly and preventing the same from moving in either a longitudinal or cross-sectional manner. The weight of the rail is sufficient to cause the jaw to move radially on the rail base of the chair and grip the rail at the points E. When the maximum weight is applied to the lugs C the jaw, in view of its narrowing at F, will be set at this point, holding the rail permanently in position, at the same time allowing for expansion and contraction.—*April 17th*, 1930.

MACHINE TOOLS AND SHOP APPLIANCES.

327,930. July 25th, 1929.—AXLE TURNING AND GRINDING MACHINES, The Churchill Machine Tool Company, Ltd., Broadheath, Manchester, and H. H. Asbridge, Claremont, Washway-road, Ashton-on-Mersey.

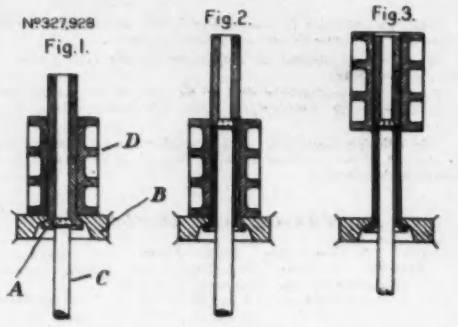
In this machine for turning and grinding railway axles, for



re-truing purposes, the slide A for the turning tool B is mounted on the tailstock C. It has a travelling feed gear D and a cut feed gear E. The grinding wheel is indicated at F. It is asserted that by these means any tendency for the tool to dig into the work, as may be the case when the slide is mounted on the machine bed, is averted.—*April 17th*, 1930.

327,928. July 24th, 1929.—A PROCESS FOR DRAWING OUT HOLLOW METALLIC BODIES, G. Müller, 12, Arnoldstrasse, Dusseldorf, Germany, and Rheinische Metallwaaren-und Maschinenfabrik, 195 Ulmenstrasse, Dusseldorf-Derendorf, Germany.

The inventors propose to make seamless tubes by a process of punching them out, from a hollow billet in a die of the finished external diameter. The billet is provided with a flange A, which secures it in the press B, while the punch C is forced forward to increase the bore. The die is shown at D. It is pointed out that if the die were of the same length as the finished tube it would be of inordinate cost, so its length is confined to about two-thirds of that of the billet. When the punch has reached the position shown in Fig. 2, the die is moved forward and the

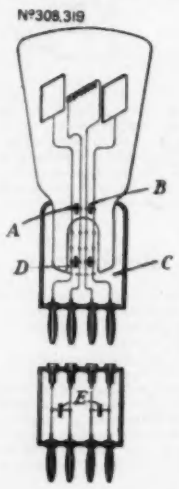


punch progresses again—see Fig. 3. In this way, by a step by step process, the whole tube is formed.—*April 17th*, 1930.

MISCELLANEOUS.

308,319. March 21st, 1929.—THERMIONIC RECTIFIERS, Siemens and Halske Aktiengesellschaft, of Berlin-Siemensstadt, Germany.

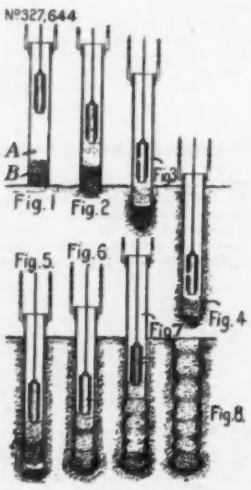
According to this invention, a smoothing circuit is provided, either in the interior of the rectifier bulb or cap or in the valve



holder. The object of the smoothing circuit is, of course, to remove ripples in the rectified current. Between each cathode and anode lead rolled condensers are provided, as shown at A and B. If desired, the condensers may be placed in the space between the cap C and the bulb, as indicated at D, or in the valve holder, as indicated at E.—*April 17th*, 1930.

327,644. June 25th, 1929.—CONCRETE PILES, *William Warren Triggs, of the firm of Marks and Clerk, 57 and 58, Lincoln's Inn-fields, London, W.C. 2.*

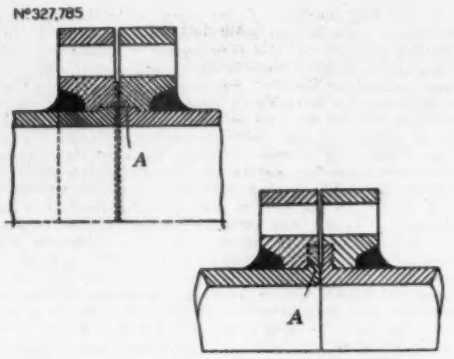
The invention relates to the construction of concrete foundation piles by ramming concrete in a withdrawable preparatory tube. It provides for use to be made of an improved method which facilitates driving and withdrawing the lining tube while preventing water, mud or soil entering the interior of this tube. Fig. 1 shows the lining tube placed upon the ground and filled at its lower part with a mass of stones B or pebbles surmounted by a mass of dry compressible concrete A. Fig. 2 shows the same tube after ramming and compression of the mass of concrete against the inner wall of the tube. Fig. 3 shows the tube



during driving, the concrete plug having descended slightly in the tube under the striking action of the ram, while a part of the stones forced out laterally have become set in the ground outside the tube. Fig. 4 shows the tube completely driven in. Fig. 5 shows the tube slightly raised and after having received a charge of fresh concrete for expelling the plug gradually by striking with the ram. Fig. 6 shows the plug completely expelled, the enlarged base of the pile being already in formation. Fig. 7 shows the construction of the pile by driving in fresh concrete which has been poured in the tube, the stones which were previously forced out into the ground being pushed back by this ground so as to become partly encrusted in the column of concrete and to form projections thereon. Fig. 8 shows the completely moulded pile with its stony projections.—*April 10th*, 1930.

327,785. January 28th, 1929.—FLANGED PIPE JOINTS, Stewarts and Lloyds, Ltd., 41, Oswald-street, Glasgow, and I. Downing, Hawthorn House, Church-street, Blackheath, near Birmingham.

The inventors propose to affix flanges to pipes by a combined



process of electric or torch welding and upsetting the end of the pipe into a recess in the flange. The flange is shrunk on to the end of the pipe and is then welded in place. It is then heated and worked out into the recess, as shown at A, mechanically. It is remarked in the specification that this heating improves the properties of the weld.—*April 17th*, 1930.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME and PLACE at which the meeting is to be held should be clearly stated.

TO-DAY.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, W. 1. Discourse, "Some Scientific Instrument Makers of the Eighteenth Century," by Mr. R. S. Whipple. 9 p.m.

TUESDAY, MAY 27TH.

INSTITUTE OF PHYSICS.—In the Rooms of the Institution of Electrical Engineers, Savoy-place, Victoria Embankment, London, W.C. 2. Presidential address, "The Influence of Physical Research on the Development of Wireless," by Dr. W. H. Eccles, F.R.S. 5.30 p.m.

WEDNESDAY TO SATURDAY, MAY 28TH TO 31ST.

INSTITUTION OF WATER ENGINEERS.—Summer meeting in London. For programme see page 542, May 16th, 1930.

FRIDAY, MAY 30TH.

ROYAL AERONAUTICAL SOCIETY.—At the Rooms of the Royal Society of Arts, John-street, Adelphi, W.C. 2. "The Development and Progress of Aircraft Engines," by Mr. H. R. Ricardo. 6.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, W. 1. Discourse, "The Metal Crystal," by Sir H. C. Harold Carpenter, F.R.S. 9 p.m.

MONDAY TO MONDAY, JUNE 2ND TO 9TH.

INSTITUTION OF GAS ENGINEERS.—Conference at Leeds. For programme see issue May 9th, 1930, page 528.

THURSDAY, JUNE 12TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Northern Irish District meeting, Manager's office, Corporation Gasworks, Ormeau-road, Belfast. 3 p.m.

SATURDAY TO SATURDAY, JUNE 21ST TO 28TH.

ROYAL SANITARY INSTITUTE.—Congress at Margate. For programme see page 534, May 9th, 1930.

TUESDAY, JUNE 24TH.

ADVERTISING CONVENTION, 1930.—Industrial Press Session Luncheon, Royal Victoria Hotel, Hastings, after which a number of speakers will give their views on various matters connected with the trade and technical Press:—Professor Henry Clay, "British Industry's Message to the World;" Mr. Holbrook Jackson, "The Voice of Industry—the Trade Press;" Mr. C. Pinkham, "The Service Expected from a Trade Journal;" Mr. P. Best, "The Trade Journal as a Link between Manufacturer and Distributor."

WEDNESDAY TO WEDNESDAY, SEPTEMBER 3RD TO 10TH.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—Bristol meeting. The presidential address, by Professor F. O. Bower, will deal with "Size and Form in Plants." Evening discourses will be given by Professor E. V. Appleton, F.R.S., on "Wireless Echoes," and by Dr. R. E. Slade on "The Nitrogen Industry and our Food Supply." Evening receptions and excursions to points of scientific interest, works, &c., in the locality will be arranged.

THURSDAY TO SUNDAY, SEPTEMBER 4TH TO 7TH.

INTERNATIONAL CONGRESS OF CONSULTING ENGINEERS.—Fifth Congress at Vienna.

THE INSTITUTION OF ELECTRICAL ENGINEERS: AWARDS OF PREMIUMS.—The Council of the Institution of Electrical Engineers has made the following awards of premiums for papers read during the session 1929–30 or accepted for publication:—The Institution Premium to Mr. H. H. Harrison; an Ayrton Premium to Messrs. B. A. G. Churcher and A. J. King; a John Hopkinson Premium to Mr. L. C. Grant; a Kelvin Premium to Mr. T. G. N. Haldane, M.A.; a Paris Premium to Messrs. H. A. Humphrey, D. M. Buist, and J. W. Bansall; and extra premiums to Messrs. S. W. Melsom, A. N. Arman, and W. Bibby; Messrs. E. H. Smythe and E. G. Weeks; Messrs. T. W. Ross and H. G. Bell; Mr. W. West; Mr. Bernard Leggett, M.R.C.S., L.R.C.P.; Mr. J. C. Prescott; and Mr. H. W. Taylor. Wireless Section Premiums: A Duddell Premium to Mr. J. E. P. Vigoureux; and extra premiums to Captain P. P. Eckersley and Mr. N. Ashbridge; Mr. G. Shearing; and Captain J. W. S. Dorling, R.N.

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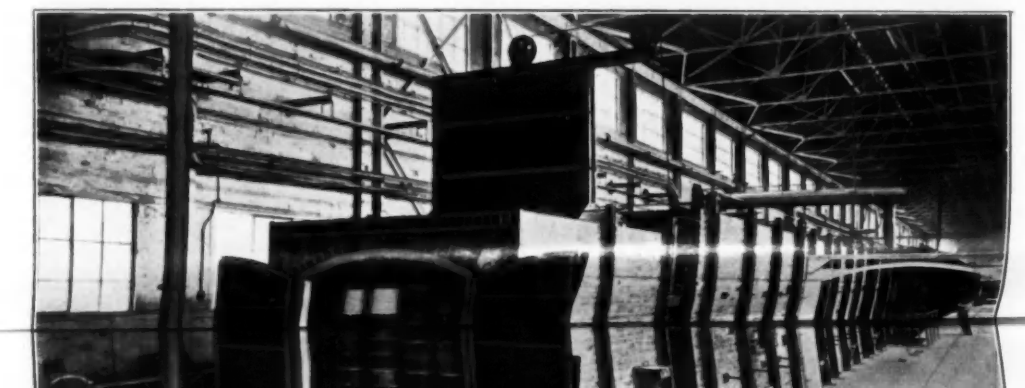
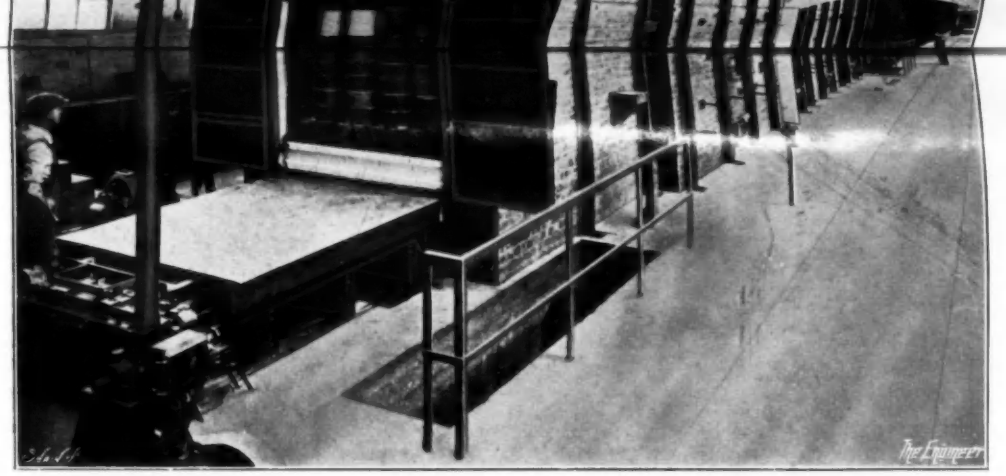
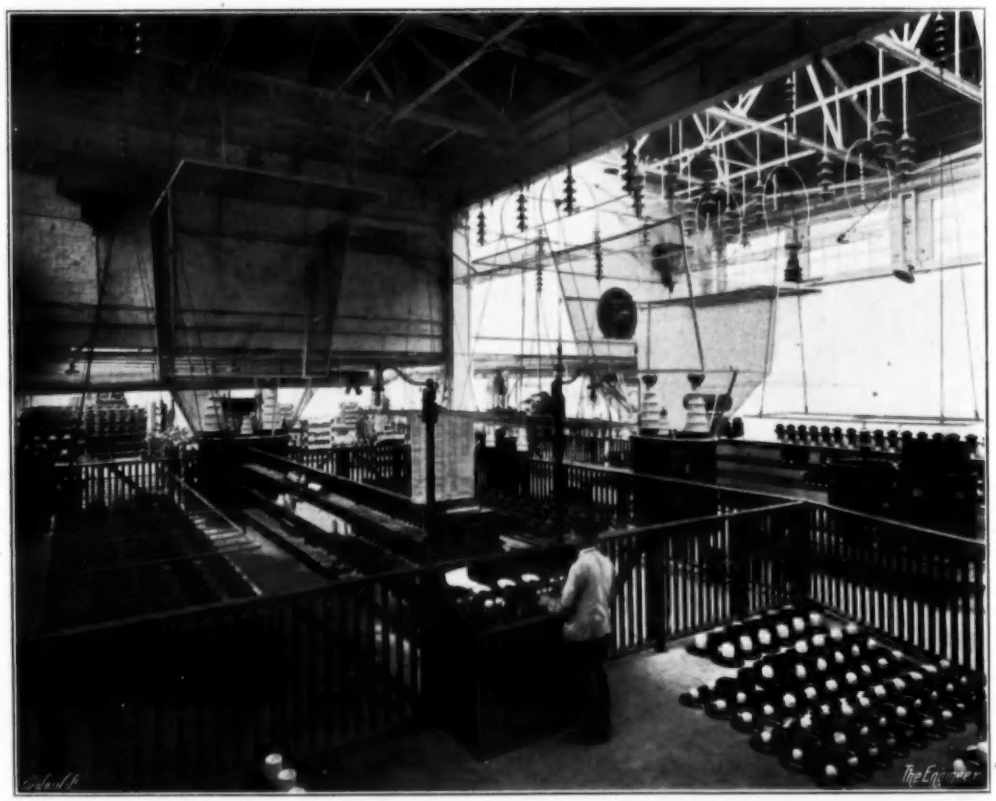


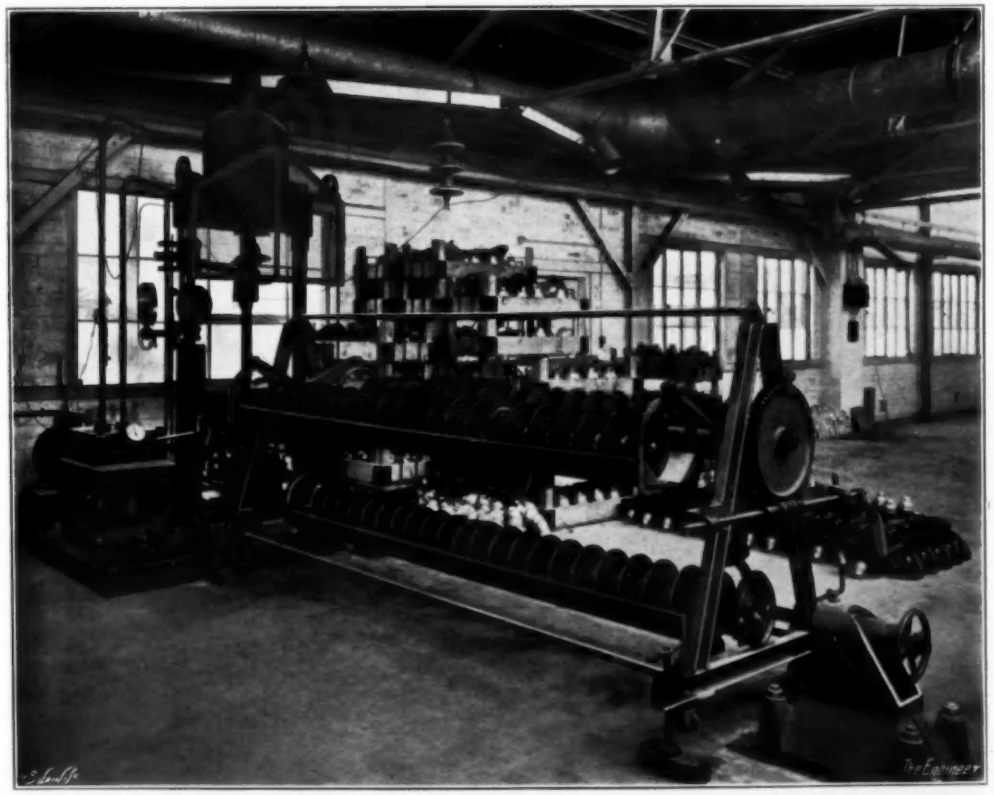
PORCELAIN TURNING AND MOULDING SHOP



CHARGING END OF TUNNEL KILN FOR PORCELAIN GOODS



ROUTINE TESTING TABLES FOR ELECTRICAL INSULATORS



CONTINUOUS MECHANICAL TESTING OF SUSPENSION INSULATORS